Ignitron electric locomotive with each cab supported on six-wheel trucks

Ignitron Locomotives Turn in Good Performance Records

In service on the Pennsylvania, the Ignitron locomotive hauled 400,440 ton-miles per train running hour as compared with 163,905 for a type GG1 electric and 122,679 for a P52 electric locomotive

By C. C. Whittaker and W. M. Hutchison
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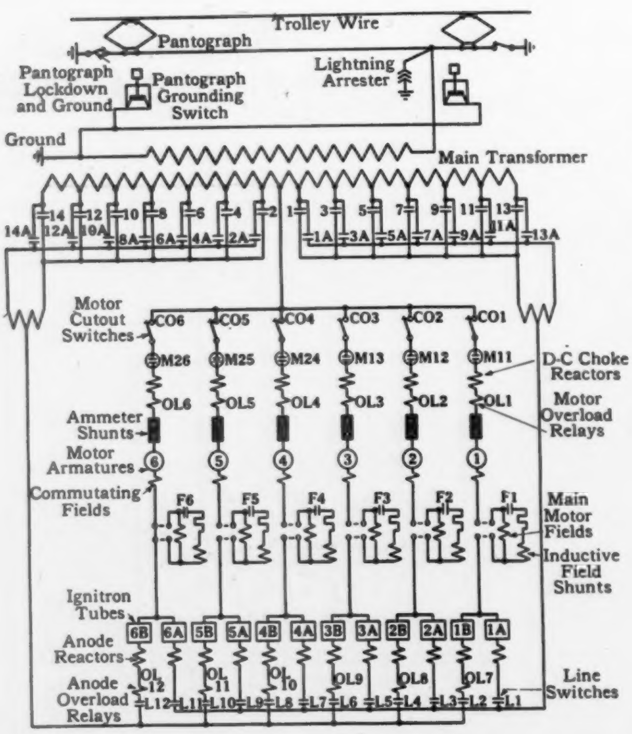
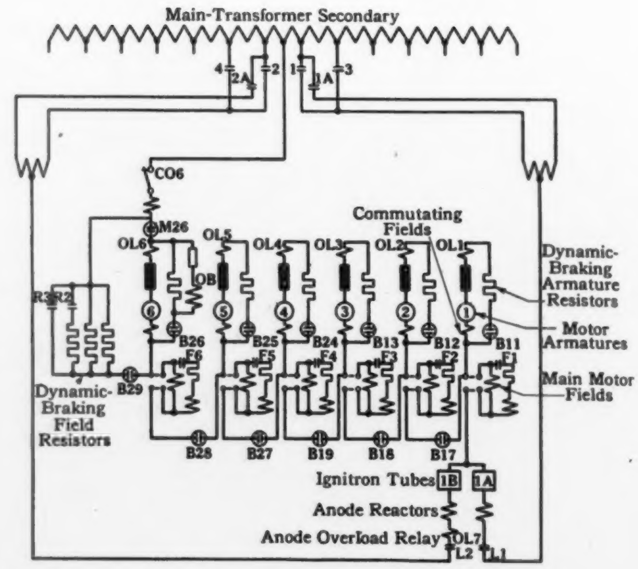
ONE day last November, a shiny new electric locomotive eased out of the Pennsylvania railroad yards at Enola, Pa. Nothing about its appearance distinguished it significantly from other locomotives of the Pennsylvania electrification. Actually, it is unlike any of its predecessors. It is the first Ignitron rectifier locomotive, and, as such, establishes another milestone in railroading. In its first big test, operating in regular revenue service, the rectifier locomotive has proved to be everything expected of it. But, in addition to providing significant advantages in present-day service, the Ignitron locomotive may have an important effect on future railroad electrification.

A few months after the first Ignitron locomotive went into service, a second similar one joined it. These two locomotives have rolled up a combined total of 60,000 miles of service and have proved eminently satisfactory in the tough freight service between Harrisburg, Pa., and the east coast.

The Ignitron locomotive represents a completely new principle of electric locomotive operation. Single-phase a.c. power from the overhead trolley is rectified by means of sealed Ignitron tubes, and the d.c. output of the rectifier is supplied to series-wound, d.c. traction motors that drive the locomotive. Thus, the economies possible with an a.c. trolley system and the tractive advantages of d.c. motors are combined in the same locomotive.



Connection of apparatus in one unit during motoring. Accelerating taps on each side of the transformer center tap feed an anode bus that supplies six Ignitron tubes. Each pair of tubes furnishes full-wave rectified power to one d.c. traction motor. The circuit is completed from each motor through a d.c. choke reactor that limits voltage ripple to 30 per cent, a motor switch, a cutout switch, and back to the transformer center tap. All six traction motors in each unit are connected in parallel. By means of phase delay on some notches, 35 notches for motoring are provided on the controller



Circuit connections for dynamic braking. Fourteen braking steps are available

Both the d.c. and a.c. systems have advantages. Low-voltage d.c. traction motors inherently cost less They also require less maintenance. The a.c. series commutator motor, although it serves its purpose well, has always had high first cost and high maintenance expense. This is because the a.c. motor requires a low operating voltage and, therefore, high current, which results in a longer commutator and more brushes per brush-holder. Also, the a.c. motor is essentially a low-flux-per-pole motor. Therefore, it has more poles than a corresponding d.c. motor, and proportionately more brush-holders. It requires a revolving brush-holder yoke and a complicated system of main and interpole field shunts and relays that have proved expensive in first cost and maintenance, especially since a failure of these devices usually carries with it a motor failure. Consequently, the d.c. series motor is preferable. On the other hand, a high-voltage a.c. trolley system reduces transmission losses and lowers first cost of electrification in comparison with d.c. transmission. Although some 1,500- and 3,000-volt d.c. systems are used, most railroad electrifications in this country use a single-phase a.c. power.

To prove that the modern Ignitron was suitable for railway service, a multiple-unit car for commuter service on the Pennsylvania was so equipped. It has given excellent, trouble-free service since 1949. The performance of that car was so successful that development, and acceptance by the Pennsylvania, of an Ignitron freight locomotive soon followed.

Although the rectifier principle as applied to locomotive service is new, the apparatus is new only in this combination and for this purpose. Each component has been proved through long service. With the exception of the rectifier and associated circuits, the apparatus on the Ignitron locomotive is similar to that on other electric locomotives.

Each of the locomotives develops 6,000 hp. in two units. This is equivalent in rail horsepower to a 7,300-hp. diesel locomotive, since diesel ratings are based on net horsepower delivered by the diesel engine to the generators. Each unit is rated at 3,000 rail horsepower and is driven through six axles by six 500-hp. d.c. traction motors.

Unusual Truck Arrangements

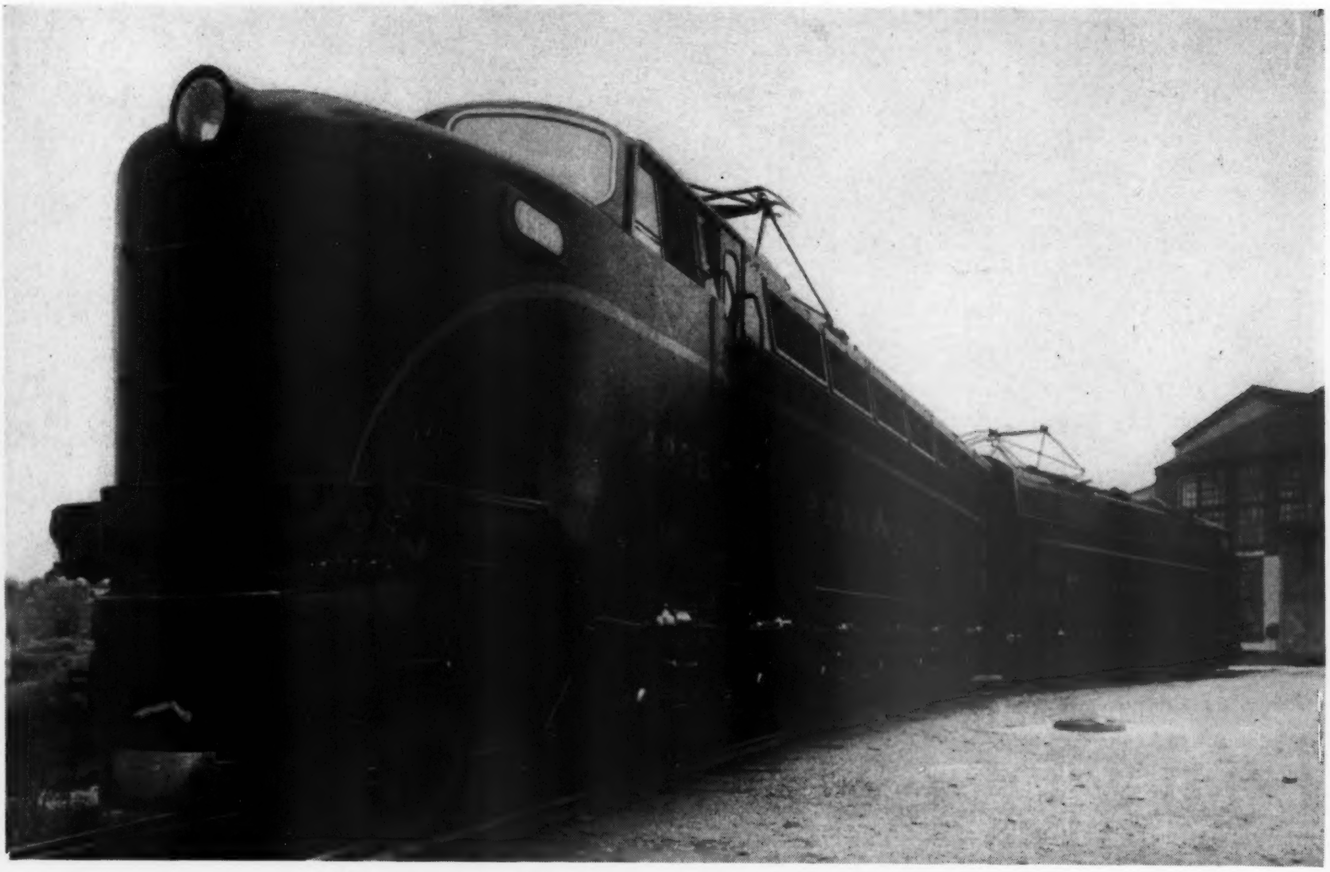
The mechanical parts on these Ignitron locomotives are similar in many respects to diesel-electric locomotive units, with the exception of the trucks. On one locomotive, each cab is mounted on three two-axle trucks. The other locomotive has more conventional three-axle trucks. This was done to prove by actual experience which type is more satisfactory.

On the locomotive with three-axle trucks, each cab is supported at three points on each truck; the center pin, located between the first two axles, and the two spring-loaded side bearing pads between the second and third axles. The center pin bearing is carried on a bolster supported from the truck frame by swing-links and springs. The side bearing pads are mounted directly on the frame.

The two-axle truck arrangement consists of three trucks per cab. This is an entirely new design for six-axle, total-adhesion (all axles driven) locomotives. The advantages include simplicity and standardization of truck design, greatly improved tracking qualities, better accessibility to motors, and improved motor ventilation.

On the new design, the center truck is free to move laterally without restraint. This and extremely soft springs and "no-lift" lateral-motion devices prevents weight shift from truck to truck when the locomotive negotiates curves or vertical irregularities in the track. The lateral motion of the end trucks is spring restrained and thus absorbs the lateral shocks that occur on curves and irregular tangent track.

When the locomotive passes over any vertical rise in the track, the center truck tends to take more of the load, but, because of the soft springs, the increase in



Two-unit Ignitron locomotive with a 2 (B-B-B) wheel arrangement

load is small and does not greatly affect the axle-to-axle load distribution. The suspension springs, being soft, have a large deflection (7½ in.) when loaded and any incremental increase in deflection causes only a small additional increase in axle load.

Another unique feature of the two-axle truck design is that the entire cab weight is carried by the side-bearing pads. The center pin serves only as a swivel bearing and to transmit the tractive force; it is hollow and is used to transmit cooling air to the motors, with a significant improvement in motor ventilation.

Running tests up to the present have shown excellent riding qualities for the three-truck locomotive cab, even at top speed on relatively rough track. Tests on the second locomotive having two three-axle trucks are not yet very extensive, but indications are that the tracking qualities will not equal the performance of the first.

Operating Experience

Any new equipment, particularly that embodying such a radical departure from existing equipment as the Ignitron locomotive, must result in significant improvements in operation and performance to gain widespread acceptance. And the proof of the performance comes when the equipment is placed in service under actual operating conditions.

During the first 60,000 miles of revenue service on the Pennsylvania, the first two Ignitron locomotives have given excellent service.

Arc-backs within the Ignitron tube, as described in a previous article (March 1952 issue of *Railway Mechanical and Electrical Engineer*), presented the greatest possibility for trouble. This is encountered in some stationary installations of Ignitron tubes, and was one of the reasons

TABLE I—PERFORMANCE OF ELECTRIC FREIGHT LOCOMOTIVES IN ROAD TESTS FROM ENOLA TO MORRISVILLE, PA. (130 MILES)

Locomotive Data	Class GG1	Class P5a	Class E2C
Type	a.c.	a.c.	a.c. to d.c.
Number of cabs	1	1	2
Continuous rail horsepower	4,620	3,750	6,000
Maximum speed (m.p.h.)	90	70	63
Total weight (lb.)	460,000	394,000	740,900
Weight on drivers (lb.)	300,000	229,000	740,900
Overall length (ft.)	79.5	62.7	124
Present tonnage ratings, Enola to Morrisville, Pa.			
Adjusted tons (factor =20)	6,000	6,300	16,800
Flat tons, 50-ton cars	4,280	4,500	12,000
Flat tons, 85-ton cars	4,850	5,100	13,600
Road Tests			
Date	Aug.23,1946	Aug.14,1946	Feb.19,1952
Rail condition	dry	dry	dry
Number of cars	76	80	162
Adjusted tons	5,895	6,158	16,588
Flat tons	4,375	4,558	13,348
Per cent of rating	98.2	97.7	98.3
Time in motion	3 hr. 28 min.	4 hr. 50 min.	4 hr. 20 min.
Average speed (m.p.h.)	37.4	26.8	30
Gross ton miles	568,750	592,540	1,735,240
Gross ton miles per train running hour	163,905	122,679	400,440

for the failure of an earlier rectifier railway car operated on the New Haven in 1914. This trouble has not been encountered either on the multiple-unit car or on the two locomotives.

A large number of notches are provided so that, during acceleration, the increase in tractive force between notches is small. This minimizes the possibility of slipping the wheels when the controller is advanced. As a result, a heavy train can be started very smoothly and without imposing excessive stress on draw bars.

The tremendous pulling power of the Ignitron locomotive was spectacularly demonstrated last February. A

(*Continued on page 74*)

General view of the Louisville, Ky. diesel-electric shop

Louisville & Nashville Expands Its Electric Shop

Although the shop is still in the process of organization, is has already developed excellent methods and facilities for diesel electrical maintenance

THE Louisville & Nashville moved its diesel electrical maintenance facilities into its present quarters at Louisville, Ky., in December, 1951, and the shop is still in the process of being equipped. The floor area now being used is 98 ft. wide, by 220 ft. long. The road now has 357 diesel locomotive units in operation, with 55 more on order.

The shop has the usual complement of equipment such as balancing machines, degreaser, baking ovens, impregnator, banding machine, lathe, drill press, etc. It is notable for devices and methods used to facilitate work.

Lower left: Fig. 1—Generator field ready for reassembly. Lower right: Fig. 2—A field coil from which the leads have been removed and replaced by busbars

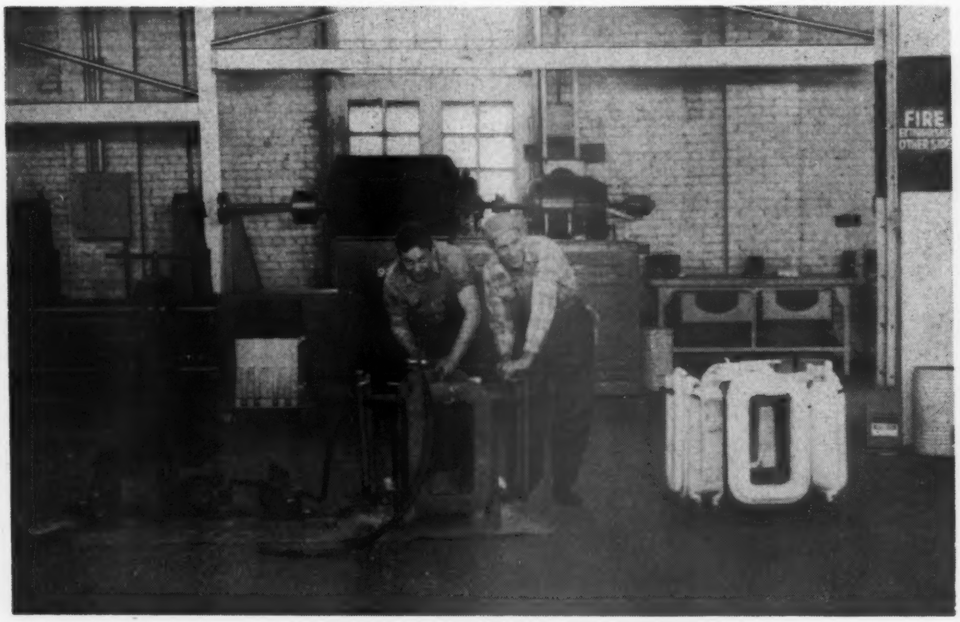
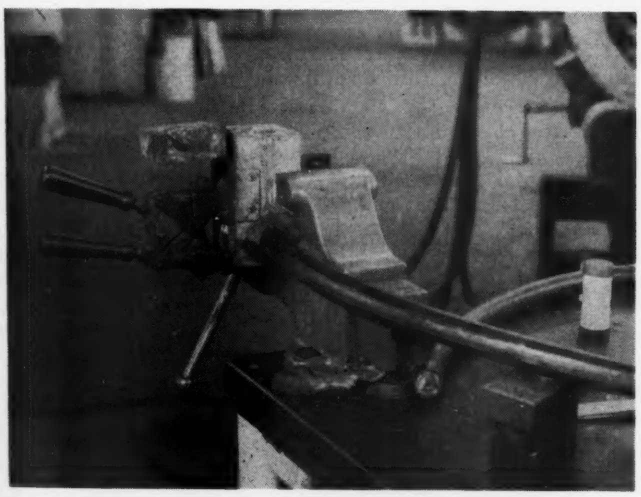


Fig. 3—Special racks are used for putting reinsulated motor field coils through the impregnator

Below: Fig. 4—Cable and terminal in a Cadweld carbon mold ready for welding. A cartridge of the welding reagent is shown at the right



Some of these are shown in the accompanying illustrations.

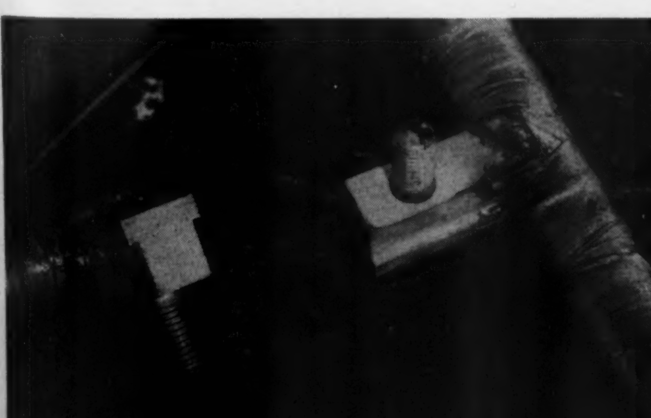
Generator fields, as shown in Fig. 1, are impregnated with coils in place. The first operation consists of cleaning the field in the degreaser for ten minutes, after which it is blown out with air. Then it is baked overnight at 250 deg. F., after which it is put through the impregnator. When the frame comes out of the impregnator, all machine fits are wiped clean with varnish solvent. Masking paint has been tried to cover the fits while the field is in the impregnator, but it has been the experience of this shop that it is just as difficult to peel off masking paint as to wipe off impregnating varnish with solvent. After the machine fits are cleaned, the field is returned to the oven where it is baked for 24 hours at 300 deg. F. The final operation consists of spraying the coils and connections with Du Pont Filmflex fast drying red varnish.

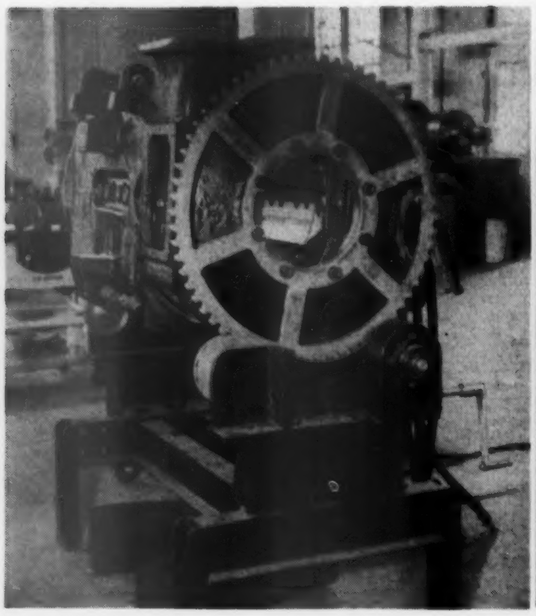
Traction motor field coils will also be impregnated with coils in place when an oven, now on order, is installed.

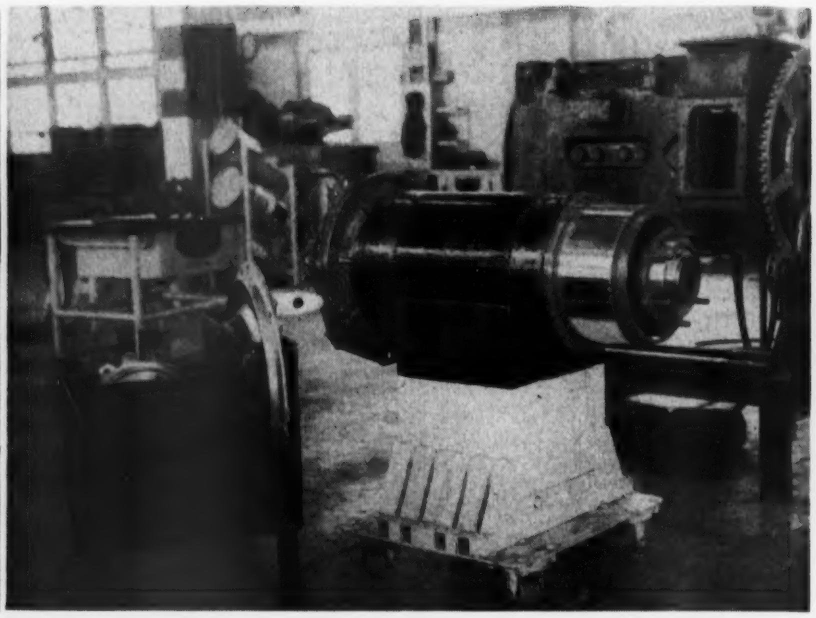
When necessary to remove or retap E.M.D. type D7 motor field coils, the flexible leads are removed, and busbar connections are made to the coil ends.

The coils are then reinsulated, and a finished coil with

Lower left: Fig. 5—Terminals applied to cables by welding. Lower right: Fig. 6—Welded cable and terminal sawed apart to show homogeneity of weld







Left: Fig. 7—Portable armature stand and parts stand. Right: Fig. 8—Traction motor frame positioner

its brazed busbar terminals appears as shown in Fig. 2. After the coils have been taped, they are hung on a special rack and put through the impregnator. Two of these racks are shown in Fig. 3. A set of main field coils and interpole field coils, are shown on a rack at the right before impregnation. In the center, there is a rack holding a set of main field coils after impregnation and a set of interpole coils lies on the floor at the left.

Connections between fields are brazed with brazing tongs. Connections between coils and brush holder rings and between coils and motor leads are welded with Cadweld electrical connections. This process consists of placing the cable and the terminal in a carbon mold which is, in turn, supported in a vise. The mold is hinged and after it is closed about the parts to be welded, it is filled with a compound of powders which will ignite and develop temperatures sufficient to weld the cable and terminal together. The powder is provided in measured quantities in cartridges, and after being poured into the mold, may be ignited with a gas lighter. The reaction requires about 10 seconds and results in a homogeneous joining of the parts as shown in Fig. 6.

Fig. 9—Each man is equipped with a portable work bench

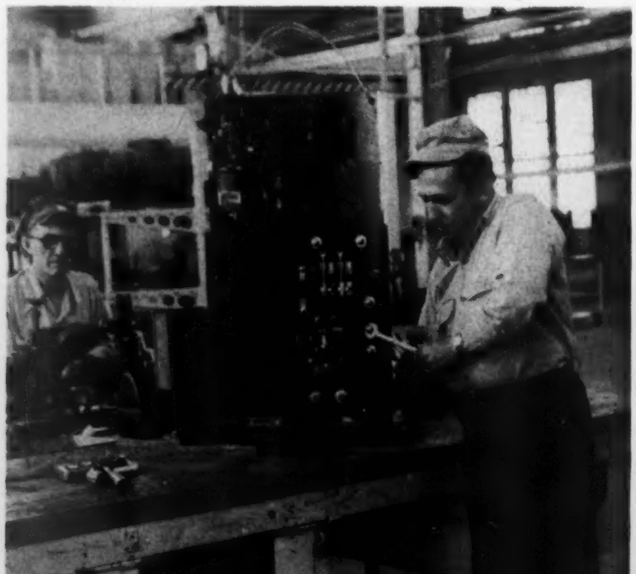


Fig. 10—The control panel positioning stand in service

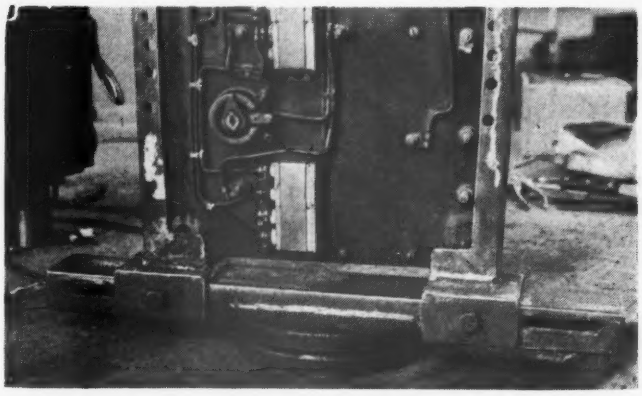
Left: Fig. 11—Brush holder cleaning stand. Above: Fig. 12—Commutator stud insulators are applied with white tape and a putty made of talc and insulating varnish. Below: Fig. 13—Control panel positioning stand

In Fig. 7 is shown a portable armature stand. Mounted on rollers, it is used for assembling armatures, bearings and bearing support housings. A second portable stand, shown at the left, has compartments for holding all the parts which are needed.

Work on motor frames is made convenient by the positioner shown in Fig. 8. The frame is secured to a smooth wheel at one end and a toothed wheel on the other. These wheels rest on a pair of rollers at each end of the positioner frame, and the rollers on the forward end have sprockets which engage with those on the wheel. The roller at the right is, in turn, geared to the handle at the lower right, and this handle may be turned to place the frame in any desired position.

Each man has a portable work bench as shown in Fig. 9. It is equipped with a 4-in. vise and a drawer for tools.

The positioner stand, shown in Fig. 13, is mounted on a bench and is used for mounting control panels of all sizes. The two vertical side members of the stand may be moved in or out from the center, and made to support the panel at its edges in a vertical position. The base of



the stand is free to rotate on the bench through 360 deg., permitting the placing of the panel in any desired position.

(*Continued on page 74*)

Left: Fig. 14—Fiber parts of power contractors are impregnated and baked. Right: Fig. 15—Motor and generator commutators are stoned in a lathe with a fixed stone

Ground Relay Protection

A discussion of how this device may best be used to detect excessive armature leakage to ground and armature flashovers

By G. R. McDonald
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General Electric Company

A PREVIOUS article* pointed out that the ground relay has a number of different functions to perform. A proper understanding of its operation can only be obtained by considering these functions one at a time. The present article is in the nature of a progress report covering work which has been done in connection with two of the protective features afforded by this important device. These are: armature leakage currents to ground, and armature flashovers.

There is quite a contrast between these two types of protection afforded by a ground relay. Armature leakage, for instance, is very much a matter of degree. Some leakage exists at all times. The question is one of deciding how much may be tolerated without affecting locomotive availability. Small currents may do no harm. Large currents may burn and damage the insulation. Armature flashover, on the other hand, permits no compromise. A flashover must be detected and stopped in the shortest possible time. These contrasting ideas are typical of the various functions which must be performed by the ground relay. They serve to fully illustrate why each function must be considered on its own merits.

The ground relay under discussion is that used with Alco-GE locomotives. It is a negative connected relay with a coil connected between the outgoing negative lead from the generator and ground, as shown in Fig. 1. The relay has a 680-ohm coil and picks up with the application of 38 volts, or a coil current of .056 ampere.

Armature Leakage

A ground in an armature at a particular point is considered in the previous article. An armature may, however, develop generalized leakage to ground. This is caused by an accumulation of dirt, moisture or, more frequently, by a combination of the two, aided and abetted by the presence of oil. This is the type of leakage occurring on a commutator string band, or from armature winding end turns. In Fig. 2 leakage of this type is considered as concentrated over one commutator string band. The leakage path might be thought of as a thin cylinder of high resistance material connected at one end to each of the commutator segments and at the other end to ground. When the armature is in operation, the voltage between brushes of opposite polarity may be considered as being divided between the commutator segments. Current will flow in the high resistance cylinder between points of different potential. This will be in many paths such as between segments and from segments to ground as partially illustrated by Fig. 2.

If the resistance of the armature to ground is measured with a megger, or by other means, a potential will be applied between the commutator side and the ground side of the resistance cylinder. From this the armature resistance to ground may be readily determined. This resistance, by calculation and test, can be related to the leakage currents which operate the ground relay.

Assume that the ground relay connection of Fig. 2 is opened. The resistance from a positive brush to ground will then be the same as that from a negative brush to ground. If voltage is applied to—or being generated by—

*Railway Mechanical & Electrical Engineer, September 1951, pages 69-75.

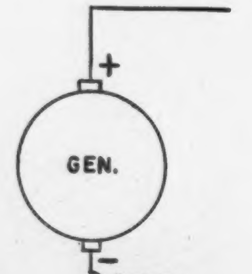


Fig. 1—Typical ground relay connection

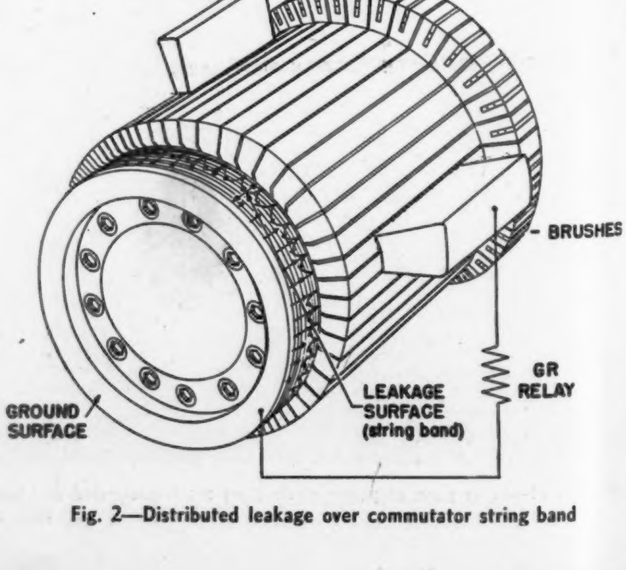


Fig. 2—Distributed leakage over commutator string band

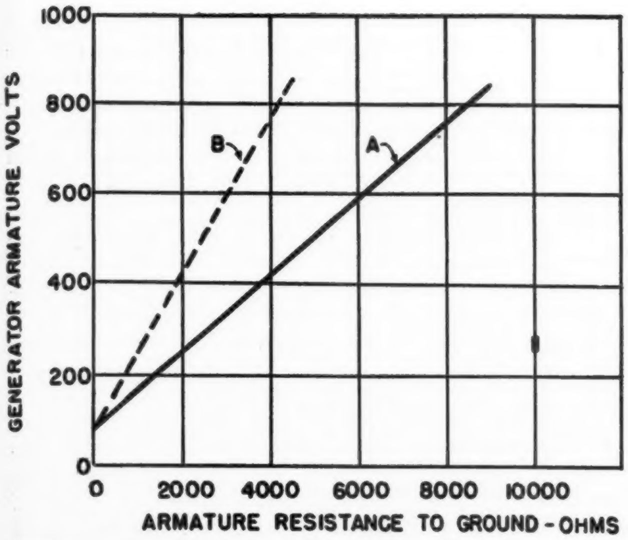


Fig. 3—Ground relay pick-up with distributed armature leakage (generator and parallel-connected motors)

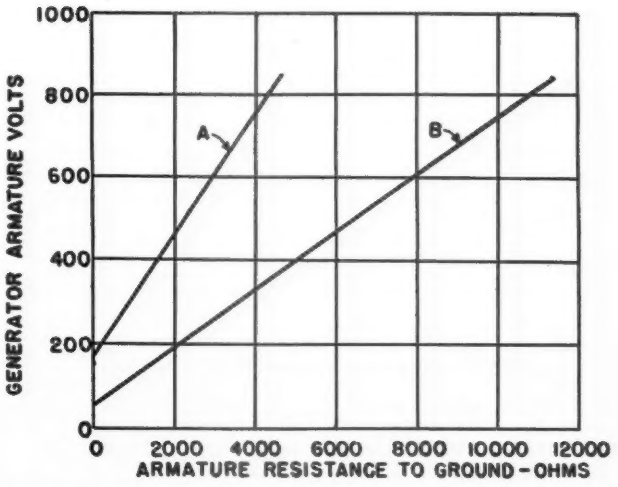


Fig. 4—Ground relay pick-up with distributed armature leakage (generator and series-connected motors)

the armature, the circulating currents in the resistance cylinder will be symmetrical with respect to ground. It is, therefore, apparent that the ground potential will be halfway between the positive and negative brush potentials of the armature.

Now if the ground relay is connected, the potential of the ground ring will be biased toward the negative of the generator. The amount of this bias will depend upon the relative resistances of the ground relay coil and of the leakage cylinder. If the resistance of the cylinder is very low compared to the relay coil, the ground potential will not be biased away from the mid-point by an appreciable amount. Approximately 50 percent of the armature voltage will be applied to the relay coil. With this condition the armature voltage must be built up to double the operating voltage of the ground relay in order to cause operation. This gives one point on curve, Fig. 3.

To obtain other points at higher armature voltages on the curve of Fig. 3, it was necessary to resort to calculations and confirming tests. Tests were made by applying a uniform layer of conducting material on a string band. Armature resistance to ground could then be measured in several well known ways. The operating point of the relay was determined by running the armature and raising its voltage until the ground relay operated. In this way enough data were obtained to complete the curve of Fig. 3.

It is interesting to note that, with all of the leakage confined to and uniformly distributed around the generator armature, an armature resistance as low as 9000 ohms to ground can be tolerated without interfering with locomotive operation.

Another interesting point is that, even with this low resistance, there was no sign of leakage current causing carbonization or permanent damage of the string band. This may be attributed to the fact that the current from any point on the commutator into the leakage surface is continually varying as the armature revolves. Thus concentrated heating at a spot is avoided.

The curve of Fig. 3 may be interpreted in various ways. Consider a locomotive in operation with four motors in parallel connected to the generator. Operation up to full generator voltage would be available without tripping the ground relay as long as the resistance of the five armatures in parallel measures 9000 ohms to ground. If all armatures have the same resistance each one would measure 45,000 ohms to ground.

In the case of a negative-connected motor only 50

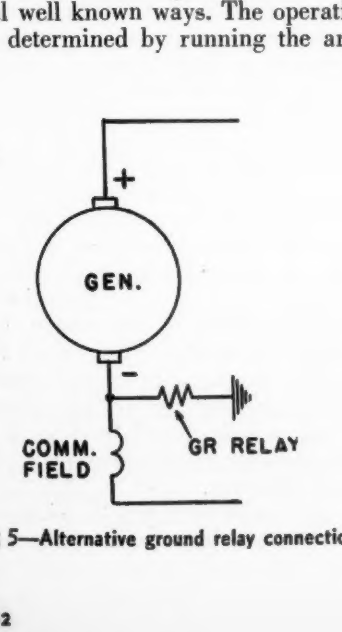


Fig 5—Alternative ground relay connection

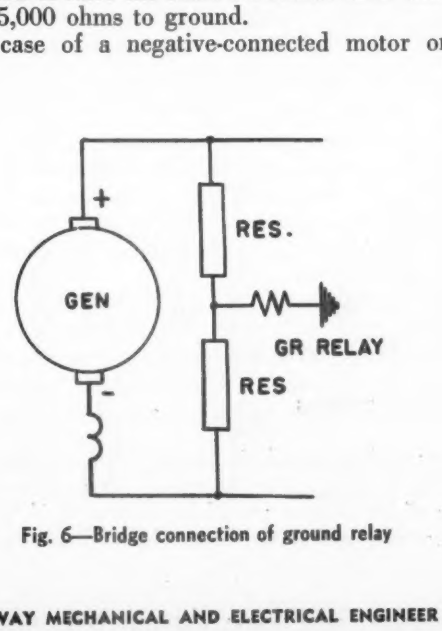


Fig. 6—Bridge connection of ground relay

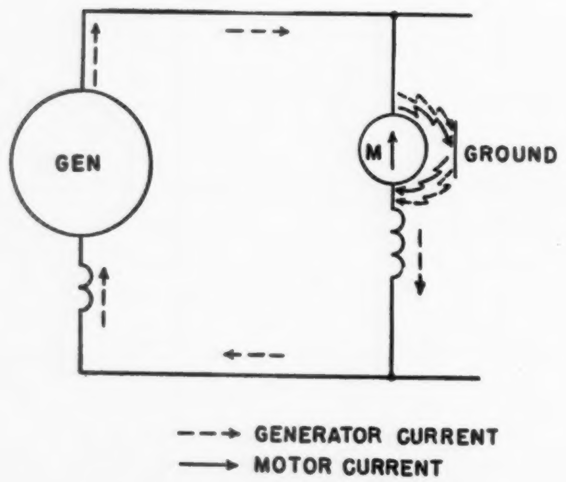


Fig. 7—Current flow during motor flashover

percent of generator voltage would be applied to its armature. The leakage would be the same as for a genrator armature except that the generator voltage would be double that of this motor armature. The voltage scale of Fig. 3 may, therefore, be doubled and the results plotted in Fig. 4.

Consider uniform leakage conditions from the armature of one of the motors connected to the positive side when operating in the series-parallel connection. It is assumed that no other leakage exists. With low armature resistance to ground the voltage applied to the relay would be due to 50 percent of this armature voltage plus the voltage of the negative-connected armature. This amounts to 75 percent of generator voltage. For the same reason the relay is more sensitive for high resistance leakage from this armature as shown by Fig. 4.

If the armature leakage is considered as coming equally from a positive and a negative connected motor, inspection will show that this is the equivalent of leakage from one full voltage armature. Then the conditions of Fig. 3 apply.

Relay Setting

As mentioned above, tests demonstrate that comparatively large leakage currents can be tolerated without damage to an armature. Also, it would be strange if all the leakage current through the relay were coming from only one armature. To insure minimum interference with locomotive operation, it would appear possible to increase the current setting of the relay to some extent. This could be accomplished easily by connecting a resistor in parallel with the ground relay coil. As far as leakage conditions only are concerned, this would be an acceptable way of raising the relay setting. However, for reasons discussed below, it would be much better to change to a lower resistance relay coil and use a resistance in series with the coil to re-establish the 38-volt pickup for the combination.

If the operating current of the ground relay were doubled the operating curve of Fig. 3 would be changed as indicated by the dotted line.

Relay Connections

In the previous article it was pointed out that the ability of the ground relay to recognize a ground on the negative of the system would be improved if the connections were changed from those of Fig. 1 to those of Fig. 5. The relay coil would be connected between ground and a point between the negative generator brushes and the generator commutating field. With this change there would also be less liability of having the relay coil short-circuited and made inoperative by a ground on the negative of the system. This change has been field tested and checked with various protective requirements of the relay with good results.

The bridge connection of the ground relay as illustrated by Fig. 6 is sometimes used. Two resistances of equal value are connected in series across the main generator. The relay coil is connected from the mid point of these two resistors to ground. Consider this connection with regard to the various motor combinations discussed above. It is apparent that this relay will not detect generalized leakage conditions of a generator armature or of parallel-connected motor armatures. When operating in the series-parallel connection, if leakage from one motor armature at a time is considered, this type of relay will give protection. If, however, the leakage is uniform from two of the series-connected armatures, the ground potential would tend to establish at the mid point of the system. Then this type of relay connection would not be operative.

Flashovers

A very important function of the ground relay is to detect armature flashovers of either the main generator or traction motors. When an armature flashes over current may flow, via arcs, in various paths and from various parts of the commutator and brush rigging. Theoretically this could take place without making any connection to ground. The design of the machines under consideration is, however, such that a flashover always involves ground in the circuit. In other words, some or all of the current from one brush holder goes to ground and from ground back to the brush holder of opposite polarity.

Generator Flashover

When a generator flashes over the armature is practically short circuited by the arc. The voltage across the armature is reduced in value and fluctuates as the arcing conditions change. Oscillograms have been taken of the voltage from brushes of opposite polarities to ground. These show approximately equal voltages from ground to each side of the armature. The voltage available to operate a ground relay connected as shown by Fig. 1 or Fig. 5 is, therefore, of a fluctuating value and is approximately half the voltage existing between the generator brushes during a flashover.

Motor Flashover

If parallel-connected motors flash over, the conditions affecting the ground relay are essentially the same as those just discussed for generator flashover. The generator current will increase because of the loss of back EMF from the motor which is flashing over. Generator current will, however, continue to pass through the field of this motor. Consequently this motor, driven by the train, will act as a generator. The current flowing in the flashover arc will be the sum of the currents supplied by the generator and by the voltage generated in the motor armature, as illustrated by Fig. 7. The sudden and large increase of generator current is likely to result in a generator flashover.

The series and commutating pole windings of motors and generators have a large part of the total reactance

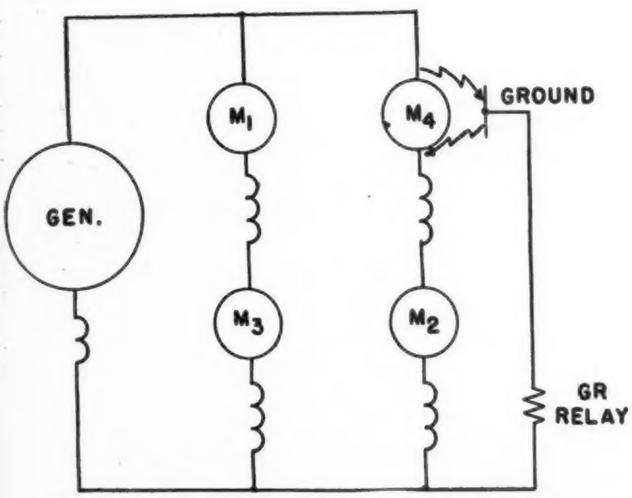


Fig. 8—Positive motor flashover, series-parallel connection

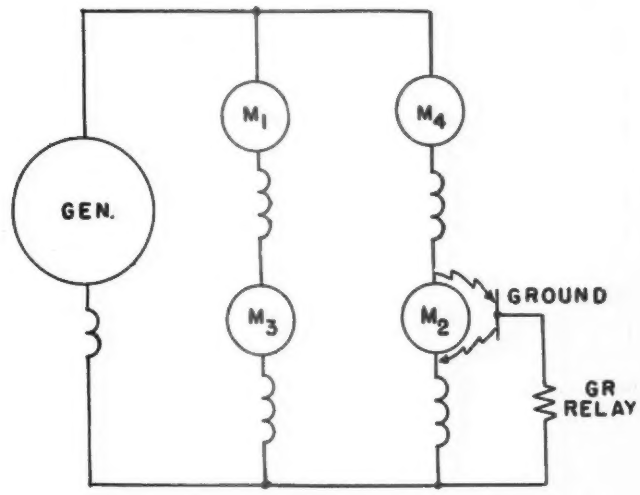


Fig. 9—Negative motor flashover, series-parallel connection

of the circuit. This reactance tends to slow up current changes. In so doing, voltages are produced across these fields which are considerably higher than steady-state values. These voltages may be in either direction, depending on whether the current is increasing or decreasing. They should be considered in connection with ground relay operation during transient conditions. The transient voltages of the motor series field will be considerably reduced if the motors are operating in a shunted field connection.

If a motor flashes over when being operated in the series-parallel connection, the voltage across this motor decreases. The voltage across the other motor in series with it is correspondingly increased. The generator current increases and passes through the field of both of these motors. The motor which is flashing over, therefore, acts as a generator. The current in the flashover arc is the sum of the generator current and that due to the motor acting as a generator. Obviously this introduces two conditions which must be considered in connection with ground relay operation.

If the motor connected to the positive side of the line flashes over, its voltage is decreased. The ground relay may be considered as being connected to the mid-point of this motor voltage. For this reason the voltage applied to the relay consists of two components—the increased voltage across the negative-connected motor and half of the voltage across the positive-connected motor. The generator voltage will be reduced somewhat by the increase in current. There will, however, be ample voltage for operating the ground relay, as indicated by Fig. 8.

If the motor connected to the negative side of the line flashes over, conditions are reversed. The voltage across this motor is considerably reduced. The generator current increases and its voltage is slightly reduced. Fig. 9 makes it obvious that the voltage available for relay operation is not as large as in other flashover conditions. In this case, the inductive voltages of the fields should be considered. For the connections shown in Fig. 1, the relay voltage consists of half the motor commutator voltage plus all of the inductive voltage of the motor field while the generator current is increasing. If the connections of Fig. 5 are considered, the inductive voltage of the generator commutating field should also be added.

During a flashover large currents flow in the circuits involved. A ground relay could be applied to operate on this current or could be arranged to operate on the voltage of part of the circuit. The relay under discussion may, for present purposes, be considered as a voltage relay having a 38-volt pickup. For reasons other than a flashover this voltage should be kept as high as possible. It should not, however, be set so high that the relay would fail to recognize a flashover. The value chosen appears to be a good compromise as indicated by operating experience and tests. Further study and operating data on the many functions of the relay will indicate the direction future improvements should take.

Speed in detecting a flashover is an essential requirement for a ground relay. As already stated, it would be desirable when raising the current setting of the relay, to use a lower voltage coil and a series resistor. This method of changing the relay calibration results in a shorter time constant for the relay coil circuit and tends toward faster operation of the relay.

Relay Connections

As mentioned above, with the particular design of motor and generator equipment being considered, all flashovers involve grounds in the circuit. The relay connections illustrated by Fig. 1 and Fig. 5 have been tried out in connection with a large number of generator flashovers. They have given prompt and positive action in detecting flashovers. The connections of Fig. 5 should, however, give better relay action in the case of a negative-connected motor flashing over during series-parallel operation. The reason for this is that the inductive voltage of the generator commutating field would assist in operating the relay.

Consider the bridge connection of the ground relay, shown in Fig. 6. It has two resistances of equal value connected in series across the main generator with the relay coil connected between the mid-point of these two resistors and ground. If the reasoning already used for generator flashover is applied to this connection, it will be seen that the ground potential should be the same as the mid-point potential between the two resistors. Therefore, except for voltage fluctuations, there is no tendency to operate the relay and detect a generator flashover. Hence this type of connection does not appear to be as positive as that of Fig. 1 or Fig. 5 in detecting a flashover of a main generator or of a parallel-connected motor.

The bridge-connected relay would appear to be quite positive in action when detecting flashovers on a series-connected motor.

Two types of protection provided by ground relays have been discussed here. Other types were discussed in the previous article. The subject is by no means fully covered by these two articles; but if they make it clear that the functions of this relay must be discussed one at a time, they will have accomplished one of their major purposes and opened the door for further progress. In this connection, it should be noted that discussing ground relays in terms of amperes to operate is a completely indefinite procedure unless other features of the relay and its circuits are also fully defined.

A great deal remains to be done in connection with the problems of moisture grounds which improperly interfere with locomotive operation. Plans have been made to actively pursue this further.

Ignitron Locomotives Turn In Good Performance Records

(*Continued from page 65*)

train made up of 162 cars of coal—the train was about a mile and a quarter long—was hauled from the freight yards at Enola, Pa., to Morrisville, Pa., a distance of 130 miles. This run is typical of hard freight service, and contains many curves and crossovers, and frequent grades. The total load on the train was 16,588 adjusted tons. (This was 13,348 actual tons. An adjustment factor of 20 has been established for the Pennsylvania electrified zones.) The run was made at an average speed of 30 miles per hour. Very little sand was applied on this difficult run. On the heaviest grades, it was necessary to use only light sanding in front of the leading truck to prevent slipping.

A good measure of the performance of freight locomotives is gross ton-miles hauled per train running hour. The usefulness of the powerful Ignitron locomotive in handling tonnage is well illustrated by the comparison in the table which gives the performance of the 6,000-hp. Ignitron locomotive (Class E2C) and the present electric locomotives (Class GG1 and P5a) as determined by road tests over the same route. The gross ton-miles per train running hour for the Ignitron locomotive is 400,440 compared with 163,905 and 122,679 for GG1 and P5a locomotives respectively.

During the test run, the minimum speed of the Ignitron locomotive up the 21.2-mile, 0.288-per cent Smithville grade, hauling a train of 162 cars loaded with coal, was 24 miles per hour.

Control Smooth-Riding Good

Extremely smooth, uniform starting is possible with an Ignitron locomotive. This minimizes the possibility of breaking a drawbar during starting. As one railroad man states, "This locomotive starts a 150-car freight train with the same ease that the GG1 (conventional a.c. locomotive) starts a passenger train."

The Ignitron locomotive can "hang on" at low speeds, that is, it can move forward at extremely slow speed without stopping and without overheating the motors. Frequently, this eliminates the necessity of stopping when the train approaches a stop signal: it can creep forward while waiting for the signal to change. This keeps the track behind it clear, so that other trains are not held up.

The Ignitron locomotive is not "slippery." This quality is achieved because the weight is equally distributed on all drivers and the d.c. motors are operated in parallel. The voltage is the same on all motors and they tend to turn at the same speed. Excessive slipping is also minimized by distributing the weight of the locomotive equally on all axles. Equal distribution of weight is essential on any locomotive.

Easy riding, though not apparently a requirement of freight locomotives, is important in extending the life of equipment and reducing maintenance expense. Men who have ridden the Ignitron freight locomotive agree that in ease of riding it excels previous locomotives.

The experience gained thus far with two Ignitron locomotives is convincing evidence that here is a valuable new addition to the motive-power equipment available for electrified railroads. It is a most satisfactory combination of the advantages of an a.c. trolley system with those of d.c. traction motors.

But perhaps the most important feature, considering long-range effects on railroad electrification, is adaptability of the Ignitron locomotive to 60-cycle power. All a.c. railroad systems in this country operate from 25-cycle power, primarily because the single-phase a.c. motor works better at low frequency. However, the Ignitron locomotive operates equally well on either 25- or 60-cycle power and makes possible future railroad electrification at commercial frequencies. Locomotive apparatus for operation at 60 cycles will be smaller and weigh less than 25-cycle equipment, and the size and cost as well as the amount of transmission and distribution apparatus can also be reduced if a frequency of 60 cycles is used. Further economies can be realized by increasing trolley voltages above the presently used 11 kv. Also, 60-cycle distribution apparatus is standardized and produced in large quantities, resulting in still further savings.

Louisville & Nashville Expands Its Electric Shop

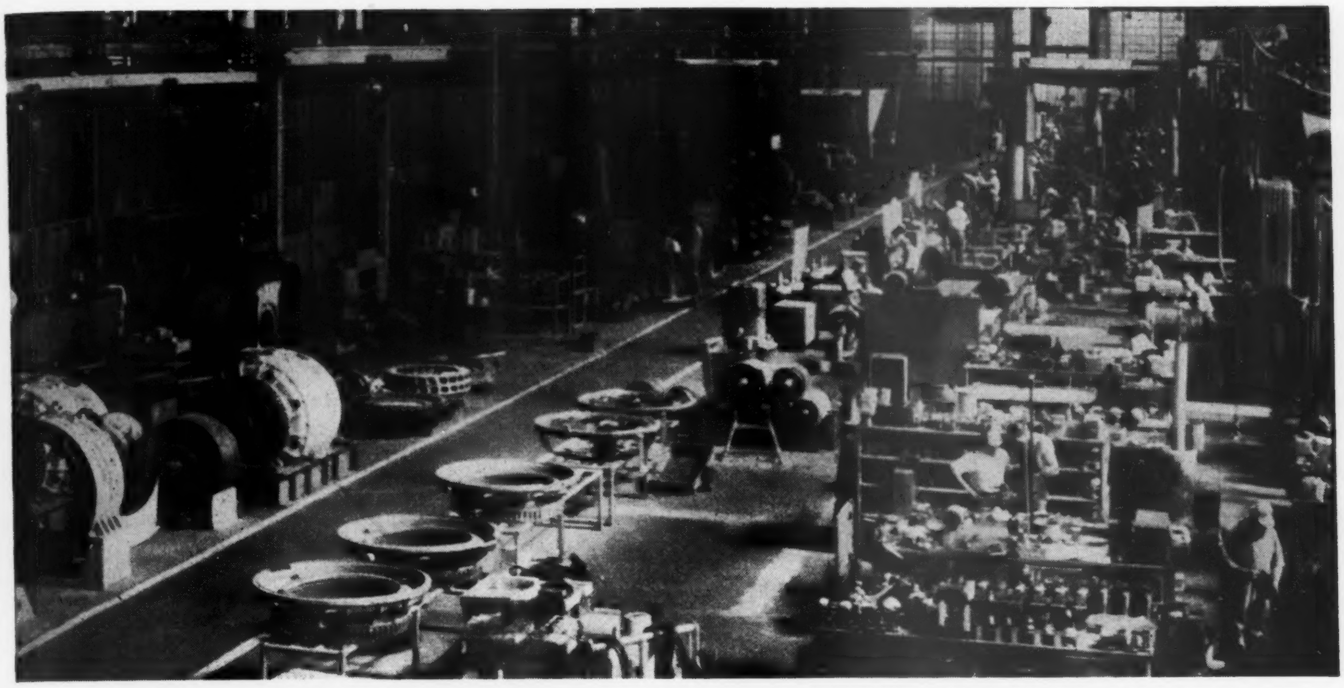
(*Continued from page 69*)

Brush holders are cleaned in a bath of Bendix carburetor cleaner with the aid of cleaning stands as shown in Fig. 12. The holders are immersed in the sump at the left. The sump is filled with cleaning solution which is agitated with air during the cleaning operation. After cleaning, the brush holders are placed on a rack at the right end of the stand as shown where they are allowed to drain. It has been found that the cleaner does not damage the brush holder insulation and is highly effective as a cleaner.

To apply porcelain insulators to brush studs, the insulated base of the stud is wound with 1¼-in. white Scotch tape. The base of the stud is covered with a mixture of Loomis Talc and R-583-Y clear baking varnish to form a putty. The insulator is partly filled with the putty and pushed over the tape. The end of the insulator is also filled with the putty, and the studs are then baked four hours at 275 deg. F.

When power contactors are overhauled, the insulating fiber parts are put in the impregnator for 45 minutes and baked for 12 hours. This produces a hard glossy finish as shown in Fig. 14, which resists mechanical abrasion and damage from flashing.

Both traction motor and generator commutators are stoned on a lathe, with a fixed stone as shown in Fig. 15.



General view of the Atchison, Topeka & Santa Fe traction motor and generator shop at San Bernardino, Cal.

Diagnosing the Condition Of Traction Motors

Routine electrical testing of traction motor armatures and field coil assemblies as practiced by the Santa Fe at San Bernardino, Cal.

The Westinghouse surge comparison tester as used in the shop

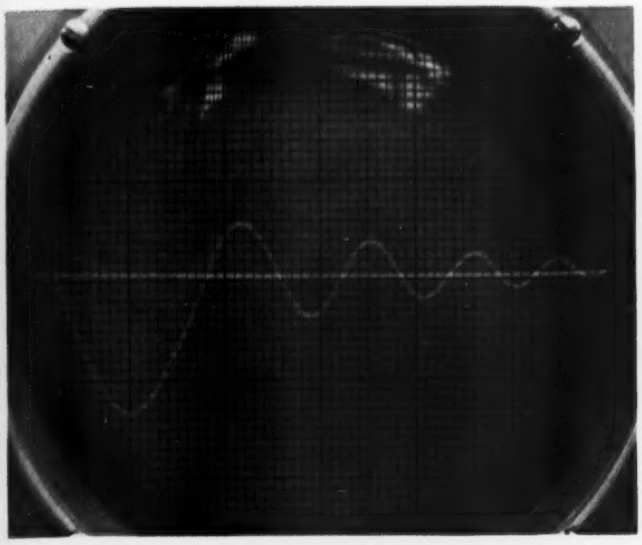
Left: The Electracer provides means for determining the exact location of a ground in a field winding. Right: A high-potential tester being used on a traction motor armature

THE Atchison, Topeka & Santa Fe has, over a period of years, developed a routine method for the electrical testing of traction motors which has proved to be highly effective. Instruments used are Megger insulation testers, ductors, high potential testers, surge comparitors and an Electracer.

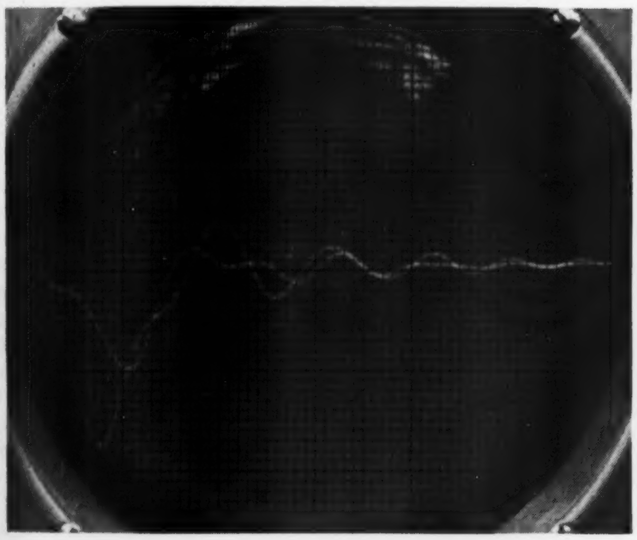
The first test made consists of measuring insulation resistance to ground with a Megger insulation tester. The reading must be in excess of 5 megohms before further tests can be applied. If the resistance is less than this value, cleaning and, if necessary, baking is used to rectify the condition.

The Megger insulation tester in one of the ductor-megger combinations being used in the first test of a traction motor armature

The Ductor as used in the Santa Fe, San Bernardino shops to find high-resistance riser or brazed back connections in a traction motor armature



A trace on the oscilloscope of the surge comparison tester which shows good insulation between coils



An indication of a short between coils are shown on the oscilloscope of the surge comparison tester

If the insulation resistance, as measured by the megger is satisfactory, a high potential of 2,600 volts is applied for two minutes. This is made with a Westinghouse burn-test high potential tester. If it passes this test, further electrical tests are applied. If not, the armature is repaired or rewound.

The armature is ductor tested to detect high resistance in riser or brazed back connections. Ductors are found best suited for this purpose because they are a low-voltage, high-current device. The ductors used are Biddle combination ductors and Megger insulation testers mounted on wheels to make them easily portable.

For making tests of short circuits between coils, the surge comparitor has been found highly satisfactory. It provides a visual proof by means of an oscilloscope screen of a short circuit between coils or a ground. The ductor and the surge comparitor complement each other, each performing the function to which it is best suited.

Experience in the San Bernardino shop has indicated the advisability of using a spark gap to determine the actual voltage being delivered by the comparitor to the armature under test. The reason for this is that the secondary voltage is dependent upon the impedance of the device being tested and the voltmeter which is in the primary circuit will give erroneous readings on low impedance devices. For this purpose, a standard spark gap is placed in parallel with the device under test with the gap set for the voltage desired as indicated by the "gap" table.

The Megger, the ductor and the high-potential testor are also used for testing field coil assemblies and an Electracer provides a rapid and a precise method of accurately locating grounds in the field coils.

The Santa Fe shop at San Bernardino, Calif., is equipped with five high-potential testing machines, two combination ductor and Megger insulation testers in portable units, two Megger insulation testers, and two Westinghouse surge comparison testers.

CONSULTING DEPARTMENT

Can High Temperature Occur at High Speeds

Some of our diesel locomotive traction motors get too hot when they are pulling high-speed, relatively lightweight trains. I am told that motors overheat only when we keep the current in the red too long. It doesn't seem to make sense to me. Can you explain why this should be so? Or isn't it?

Heating of Diesel-Electric Locomotive Traction Motors

Heat is generated in the operation of any motor, and unless removed, will cause temperatures to continually rise until insulation is damaged, solder is melted, or other damage is done. A ventilating system is provided, therefore, to remove this heat. A motor is normally given a continuous rating at the maximum current for which the ventilating system will continuously remove all of the heat liberated within the motor and keep its temperature within safe limits. This rating is usually based upon current flow (or tractive force due to current flow) because a major portion of the heat loss is due to this current flow.

While a fixed temperature limit is generally set by the character of the insulating materials, it is inevitable that some surfaces within the motor may be hotter or cooler than the average because of the impossibility of distributing the ventilating air evenly to all parts of the motor.

Any current flow higher than the rated current will increase the motor temperature, and current values below the continuous rating will result in temperatures below the safe limit. However, if a motor is operating at a temperature below the safe limit, the copper and

steel parts have the ability to absorb some heat. It is, therefore, permissible to apply an overload for a short time before the temperature is brought up to the rated value. The magnitude and duration of these short time overloads are dependent upon the type of motor and its temperature at the time the overload is applied.

Although the most important portion of the heat liberated within a traction motor is due to the propulsion current that flows through the conductors, there are other important losses that appear in the form of internal heat. Among these are:

(1) Heat generated by magnetic reversals in the steel parts of the motor. (iron loss)

(2) Heat caused by the flow of local circulating currents induced within the copper and steel parts. (stray current loss)

(3) Heat resulting from friction of brushes on the commutator. (friction loss)

(4) Heat generated by the churning of air within the motor. (windage loss)

In a well-designed motor, the approximate proportions of the liberated heat may be:

Armature copper loss due to propulsion current	30 per cent
Field circuit copper loss due to propulsion current	50 per cent
Magnetic reversals (iron loss)	12 per cent
Induced currents (stray current losses)	5 per cent
Friction	1 per cent
Windage	2 per cent
	100 per cent

Nearly all of these, except the copper losses, may be considered to vary almost directly with the speed of the motor. The copper losses vary as the square of the current.

It is apparent that the controlling element in motor heating is the propulsion current. For example, assume that a motor has a continuous rating of 1,000 amp. and the diesel engine of the locomotive is large enough to drive the train at 36 m.p.h. at this current. The heat losses at one point above and at two points below this continuous rating are:

Percentage of	(Over-loaded)	(Contin-uous)	(Underloaded)	
	1,100 amp.	1,000 amp.	900 amp.	800 amp.
Percentage of liberated heat	117	100	89	81
Miles per hour	31	36	43	54

These figures show that overloads can be applied safely only when the motor has been operating below its rated temperature, and that there should be no danger of overheating whenever the current values drop below the continuous rating.

In applying locomotives to a given service, the mistake is often made of considering only the current and tractive force ratings of the equipment and assuming that full ventilation is available at all times. This error is easily made and often causes some cases of overheating that are not readily understood. However, in many of the diesel-electric locomotives in service, the traction motor blowers are driven by the engine in such a manner that blower speed varies with the speed of the engine. Thus, when full power is not needed to maintain train speed, the engine speed is reduced, and at the same time, the traction motor ventilation is decreased. This creates a dangerous situation because the tractive force requirements are not usually reduced in the same proportion that the power demand is reduced. Two examples may

be cited to show the situation resulting when full power is not required, but the tractive force needed to keep the train moving is high.

In the first case, assume that a locomotive is hauling a capacity train on a grade where the full continuous tractive force is needed, and that full power (and hence ventilation) is being applied. If, then, the engineer gets a slow order, he must reduce the power of the engine in proportion to the necessary reduction in train speed, yet the tractive force and current flow to keep the train moving changes very little. With the full continuous current still flowing and nearly the full amount of heat being liberated, the reduction in motor ventilation resulting from lowered engine speed will tend to overheat the traction motors.

The second example is, perhaps, a little more difficult to understand, but arises from the same cause. If a lightweight train is pulled by a locomotive having relatively high power, there are combinations of grade conditions and speed limitations where full tractive force is needed, but again the engine speed must be lowered to limit the top train speed and the ventilation is consequently reduced. In this case, there is another probability—that the paths of this reduced air flow may be distorted by the fan action of the armature, which is still rotating at high speed. A distortion of the air distribution through the motor may create new "hot spots" in the armature, such as at commutator risers. This condition has been noted on a few railroads where solder has melted at the point where the armature conductors are soldered to the commutator risers. Some engineers have attributed this to excessive heat flowing to, and concentrated at, this point from two different sources,—copper and stray current losses within the armature windings, and high friction losses generated by the pressure of the carbon brushes against the commutator. This hardly seems plausible, however, and the former explanation seems much more likely.

The application engineer, in determining locomotive hauling capacities, must give due regard to those operating conditions that may result in the reduction of ventilating air flow or in an increase in temperatures of this air above that of the surrounding atmosphere. To neglect either of these factors is to invite overheating.

A. H. Candee
Westinghouse Electric Corporation

Programs Coordinated Mechanical Association Meetings

Chicago, September 15, 16, and 17

Exhibit

Tuesday afternoon, September 16, set aside for inspection of electrical products on exhibit at the Hotel Sherman under the auspices of the Railway Electrical Supply Manufacturers Association, of which W. E. Lynch (General Electric Company) is president and J. C. McPrice (Allen-Bradley Company) is secretary-treasurer.

Coordinating Committee Officers

The officers of the Coordinating Committee, which consists of the presidents and secretaries of the railway associations and the exhibiting organization, are: Chairman, J. P. Morris, general manager, mechanical department, Atchison, Topeka & Santa Fe; F. K. Mitchell, manager equipment, New York Central system, and secretary, C. F. Weil.

Electrical Section of the Engineering and Mechanical Division, A.A.R.

Hotel Sherman
Monday, September 15
10 a. m.

Address by H. F. Finnemore (chairman, Electrical Section), chief electrical engineer, Canadian National.

Business session.

Election of officers.

Discussion committee reports on:

Wire, Cable and Insulating Materials, C. R. Troop (chairman), assistant engineer, New York Central System.

Electrolysis, H. P. Wright (chairman), assistant electrical engineer, Baltimore & Ohio.

Application of Corrosion-Resisting Materials to Railway Electrical Construction, S. R. Negley (chairman), electrical engineer, Reading.

Power Supply, C. P. Trueax (chairman), assistant electrical engineer, Illinois Central.

2 p. m.

Special reports on New Orleans Union Passenger Terminal, by C. J. Wallace, manager, New Orleans Union Passenger Terminal, and J. M. Trissal, assistant chief engineer, Illinois Central.

Discussion committee reports on:

Electric Heating, C. A. Williamson (chairman), electrical engineer, Texas & New Orleans.

Application of Radio and Communicating Systems to Rolling Stock, W. S. Heath (chairman), electrical assistant, Atchison, Topeka & Santa Fe.

Tuesday, September 16
9 a. m.

Discussion committee reports on:

Illumination, L. S. Billau (chairman), electrical engineer, Baltimore & Ohio.

Wiring Diagrams for Rolling Stock, E. J. Feasey (chairman), general supervisor of diesel equipment, Canadian National.

Car Electrical Equipment, S. B. Pennell (chairman), assistant engineer, New York Central System.

Welding and Cutting, L. E. Grant (chairman), engineer of tests, Chicago, Milwaukee, St. Paul & Pacific.

12 Noon

Joint luncheon with Railway Electric Supply Manufacturers' Association and Allied Railway Supply Association. Speaker, J. P. Kiley, president, Chicago, Milwaukee, St. Paul & Pacific.

Wednesday, September 17
9 a. m.

Discussion committee reports on:

Car Air Conditioning Equipment, A. E. Voight (chairman), car-lighting and air-conditioning engineer, A.T.&S.F.
Electrical Facilities and Practices for Repair Shops.

1:45 p. m.

Committee on Automotive and Electric Rolling Stock, C. A. Wilson (chairman), general supervisor diesel engines, Atchison, Topeka & Santa Fe. (Joint session with L.O.M.A.)

Exhibitors—1952

Railway Electric Supply Manufacturers Association

Allen-Bradley Company Chicago
Anderson Mfg. Co., Albert & J. M., Chicago
Berger Co., George R., Chicago
Biddle Co., James G., Philadelphia
Bogue Electric Mfg. Co., Paterson, N. J.
Bogue Railway Equipment Div.,
Brady Company, W. H., Milwaukee
Buchanan Electric Products Corp., Chicago
Buckeye Telephone & Supply Co., Columbus
Bussmann Mfg. Co., Chicago
Dayton Rubber Company, Dayton
Dow Corning Corp., Midland, Mich.
Edison, Inc., Thomas A., Chicago
Electric Storage Battery Co., Chicago
Equipment Research Corporation, Chicago
Farr Company, Chicago
Federal Electric Products Co., Chicago
General Electric Company, Chicago
Gould-National Batteries, Inc., Chicago
Ideal Industries, Inc., Sycamore, Ill.
K. W. Battery Company, Inc., Skokie, Ill.
Luminator, Inc., Chicago
Minneapolis-Honeywell Regulator Co., Minneapolis
Modern Railroads Publishing Co., Chicago
National Carbon Div., Union Carbide & Carbon Corp., New York
National Electric Coil Company, Columbus
National Electric Products Corp., Chicago
Nife Incorporated, Copiague, Long Isalnd, N. Y.
Okonite Company, Chicago
Pyle-National Company, Chicago
Railway Mechanical & Electric Engineer, Chicago
Safety Car Heating & Lighting Co., Inc., Chicago
Spicer Manufacturing Div. of Dana Corp., Toledo
Sticht Co., Inc., Herman H., New York
Thomas & Betts Company, The, Chicago
Trumbull Electric Department of General Electric Company, Chicago
Vapor Heating Corp., Chicago
Waukesha Motor Company, Waukesha, Wis.
Western Lithograph Company, Los Angeles
Westinghouse Electric Corp., East Pittsburgh, Pa. and Chicago

Air Brake Association

MORRISON HOTEL

MONDAY, SEPTEMBER 15
10 A. M.

Address by President K. E. Carey.

Proper Procedure of Repairing and Handling Air Brake Equipment—Central Air Brake Club.

To create, by Association, a Closer Interest of Air Brake Men, by G. W. Misner, Westinghouse Air Brake Company.

Methods of Measuring System Leakage—St. Louis Air Brake Club.

2 P. M.

Freight and Passenger Train Handling and Dynamic Braking (Joint session with R. F. & T. E. A.), T. H. Bickerstaff (chairman), supervisor air brakes, Atchison, Topeka & Santa Fe.

TUESDAY, SEPTEMBER 16
9 A. M.

Address by J. W. Hawthorne, general superintendent motive power and equipment, Atlantic Coast Line.

Air Leakage on the Individual Car, by Martin Alger, Jr., New York Air Brake Company.

Standardization of Air-Brake Equipment for Diesel and Turbo-Electric Locomotives, C. E. Miller (chairman), supervisor air brakes and steam heat equipment, New York Central System.

Report Approved Maintenance Practice Committee, F. W. Dell (chairman), Grand Trunk Western.

The Release Control Retainer as a Means for Better Braking—Manhattan Air Brake Club.

WEDNESDAY, SEPTEMBER 17
9 A. M.

The Brake Cylinder Release Valve, by L. A. Stanton, general air-brake instructor, Great Northern.

Maintenance and Repairs of Diesel Locomotive Air Compressors—Pittsburgh Air Brake Club.

Symposium an Automatic Freight-Car Slack Adjusters.

2 P. M.

Completion of papers and discussion of committee reports.

Election of officers.

Unfinished business.

Car Department Officers' Association

HOTEL SHERMAN

MONDAY, SEPTEMBER 15
10 A. M.

Address by President W. N. Messimer, general superintendent equipment, Merchants Despatch Transportation Corporation.

Address by A. E. Wright, vice-president and general manager, Manufacturers Railway, and president and general manager, St. Louis Refrigerator Car Company.

Report of Committee on Interchange and Billing for Car Repairs, J. J. Sheehan (chairman), supervisor car repair bills, Missouri Pacific.

2 P. M.

Report of Committee on Air-Conditioning Equipment—Operations and Maintenance, R. F. Dougherty (chairman), general electrical and air conditioning inspector, Union Pacific.

Report of Committee on A. A. R. Loading Rules, A. C. Bender (chairman), joint supervisor car inspection, Cleveland Car Inspection Association.

TUESDAY, SEPTEMBER 16
9 A. M.

Report of Committee on Inspection, Conditioning and Repairing Cars for Higher Commodity Classification, T. E. Hart, chief car inspector, New York, Chicago & St. Louis.

Comments by C. A. Naffziger, director, National Freight Loss and Damage Prevention Section, Association of American Railroads.

Report of Committee on Car Lubrication, K. H. Carpenter, superintendent car department, Delaware, Lackawanna & Western.

Comments by W. M. Keller, director mechanical research, Association of American Railroads.

WEDNESDAY, SEPTEMBER 17
9 A. M.

Report of Committee on Analysis of Train Yard Operation, W. B. Medill, master car repairer, Southern Pacific.

Report of Committee on Wheel-Shop Practices, E. W. Kline, general wheel shop foreman, Baltimore & Ohio.

Report of Committee on Painting—Some Aspects of Railway Equipment Maintenance, F. M. Vogel, painter foreman, Denver & Rio Grande Western.

Miscellaneous reports.

Election of officers.

Locomotive Maintenance Officers' Association

HOTEL SHERMAN

MONDAY, SEPTEMBER 15
10:30 A. M.

Apprentice Training—Committee on Diesel Personnel Training, E. V. Myers (chairman), superintendent motive power, St. Louis-Southwestern.

Thirty-five Years of Progress in the Enforcement and Observance of Laws Intended to Improve the Safety and Efficiency of Railway Operation, by W. J. Patterson, member, Interstate Commerce Commission.

2 P. M.

Oil Leaks, Crankshaft and Bearing Failures—Committee on Diesel Mechanical, J. W. Luke (chairman), general supervisor diesel engines, Atchison, Topeka & Santa Fe.

Possibilities of Diesel Parts Reclamation—Committee on Diesel Material Reconditioning and Control, F. Thomas (chairman), assistant to general superintendent equipment—diesel and electric, New York Central System.

TUESDAY, SEPTEMBER 16
9 A. M.

Standardization, Control and Distribution of Tools for Diesel Work—Committee on Shop Tools, F. E. Molloy (chairman), superintendent motive power, Southern Pacific.

12 P. M.

Luncheon honoring all railroad presidents. Speaker—J. P. Kiley, president, Chicago, Milwaukee, St. Paul & Pacific.

WEDNESDAY, SEPTEMBER 17
9 A. M.

Diesel Locomotive Cleaning; Improving Productivity of Steam Locomotives—Committee on Shop Practices, C. H. Spence (chairman), superintendent shops, Baltimore & Ohio.

Determination of Diesel Facilities—Committee on Diesel Terminal Facilities, H. E. Niksch (chairman), superintendent motive power and equipment, Elgin, Joliet & Eastern.

Team Work—A Safety Essential, by E. H. Davidson, director, Bureau of Locomotive Inspection, I. C. C.

2:15 P. M.

Wheel Slip Detection—Committee on Other Diesel Maintenance, F. Thomas (chairman), assistant to general superintendent equipment—diesel and electric, New York Central System.

Flashovers, Cause and Prevention—Committee on Diesel Electric, W. P. Miller (chairman), assistant to chief mechanical officer, Chicago & North Western.

Master Boiler Makers' Association

HOTEL SHERMAN

MONDAY, SEPTEMBER 15
10 A. M.

Address by President Harrcy C. Haviland.
Report of Executive Board.
Financial report.
Message by Secretary-Treasurer Albert F. Stiglmeier.
Association business.

2 P. M.

Address by William C. Wardwell, superintendent equipment, New York Central System.

Report on Topic No. 2—Study and recommendations for water tanks on diesel locomotives to better facilitate inspection and washing. S. E. Christopherson (chairman), retired supervisor of boiler inspection and maintenance, New York, New Haven & Hartford.

Report on Topic No. 1—Study of the advantages and disadvantages of steam heat plants, A. E. DeForest (chairman), assistant to superintendent of equipment, Michigan Central.

Association business.

TUESDAY, SEPTEMBER 16
9:30 A. M.

Report of Committee on Law.

Address by E. H. Davidson, director, Bureau of Locomotive Inspection, I. C. C.

Report on Topic No. 3—Study and recommendations on method of staying side sheets and crown sheets with view to eliminate threading holds, F. E. Milligan (chairman), general boiler inspector, Canadian Pacific.

Election of officers.

WEDNESDAY, SEPTEMBER 17
9:30 A. M.

Report of Executive Board.

Address by C. T. DeWitt, superintendent of safety, Northern Pacific.

Report on Topic No. 4—Study and recommendations for the welding and brazing of diesel locomotive and tender parts, Joseph Michne (chairman), welding instructor, New York Central.

History, Progress and Development in the Manufacture and Repair of Locomotive Boilers and Tenders, by C. B. Peck, editor, *Railway Mechanical and Electrical Engineer.*

Water treatment as presented and discussed by the Master Boiler Makers' Association during the past 50 years, by Carl A. Harper, general boiler inspector, Cleveland, Cincinnati, Chicago & St. Louis.

2 P. M.

Report of Committee on Memorials.

Report on Topic No. 5—What can the boiler supervisors do to better educate themselves for positions other than boiler supervisor, F. E. Godwin (chairman), system chief boiler inspector, Canadian National.

Selection of topics for 1953 meeting.
Report of Committee on Resolutions.
Association business.

Railway Fuel and Traveling Engineers' Association

HOTEL SHERMAN

MONDAY. SEPTEMBER 15
10 A. M.

Address by President R. H. Francis.
Secretary's report.

Water Treatment—Steam and Diesel Locomotives, G. E. Anderson (chairman), general fuel supervisor, Great Northern.

Improvement and Efficiency in the Use of Coal for Steam Locomotives, C. R. Patterson (chairman), fuel supervisor, Canadian National.

Excitation System Alco-G.E. Diesel Locomotives (with slides), R. D. Nicholson (chairman), general road foreman engines, New York, New Haven & Hartford.

2 P. M.

Passenger-Train Handling; Freight-Train Handling; Dynamic Braking, T. H. Bickerstaff (chairman), supervisor air brakes, Atchison, Topeka & Santa Fe. (Joint session with Air Brake Association.)

TUESDAY, SEPTEMBER 16
9 A. M.

Definition of Specifications for Diesel Fuel Oil, T. L. Henley (chairman), chief fuel supervisor, Missouri-Kansas-Texas.

Use of Diesel Fuel Oil and Loss of Fuel, T. L. Henley (chairman), chief fuel supervisor, Missouri-Kansas-Texas. Steam Generators—Trouble Shooting, etc., W. H. Fortney (chairman), chief road foreman engines, Cleveland, Cincinnati, Chicago & St. Louis.

Safety on Railroads and Proper Observance of Signals, by H. P. Hamilton, St. Louis-San Francisco.

Diesel Operation, Including Improper Handling of Locomotives, R. R. Rich (chairman), road foreman of equipment, Chicago, Rock Island & Pacific.

Train Delays Caused by Diesel Failures—Cause and Remedies, T. J. Conway (chairman), fuel supervisor, Texas & Pacific. (operating), Texas & Pacific.

Employe and Public Relations, by L. C. Porter, vice-president (operating), Texas & Pacific.

WEDNESDAY, SEPTEMBER 17
9 A. M.

Safety Precautions on Diesel Locomotives, R. D. Nicholson (chairman), general road foreman engines, New York, New Haven & Hartford.

Importance of Making Proper Reports, etc., by Edward H. Davidson, director, Bureau of Locomotive Inspection, I.C.C.

Tracing Schematic Wiring Diagrams of EM Model F-7, E-8, GP-7 Diesel-Electric Locomotives (with slides), F. G. LaMaster (chairman), system fuel supervisor, Chicago, Burlington & Quincy.

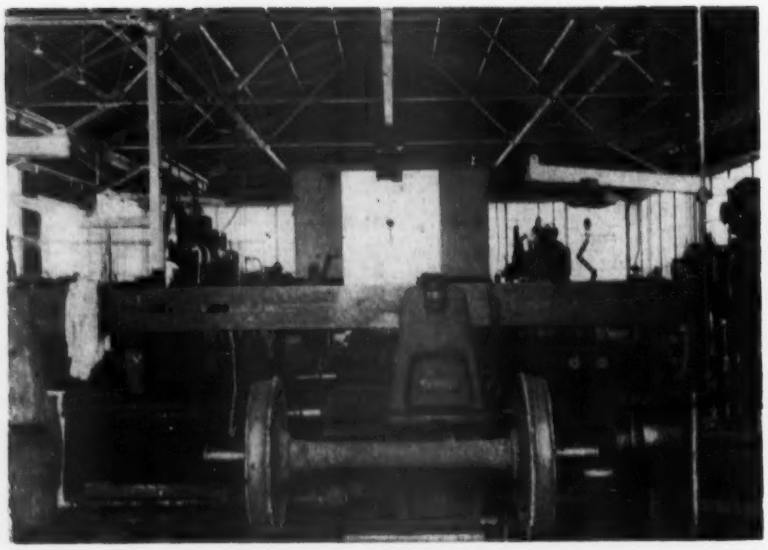
Prevention of Loss and Damage and Personal Injuries Due to Rough Handling, G. B. Curtis (chairman), road foreman of engines, Richmond, Fredericksburg & Potomac.

2 P. M.

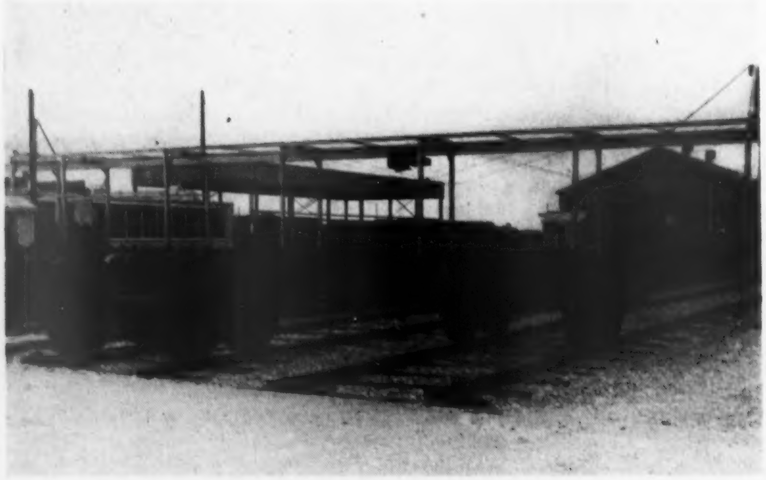
Results of Election.

Air Pollution and Smoke Abatement, M. G. Stewart (chairman), road foreman of engines, Washington Terminal Co.

Education of Road Supervision and Engine Crews, R. H. Francis (chairman), general road foreman equipment, St. Louis-San Francisco.

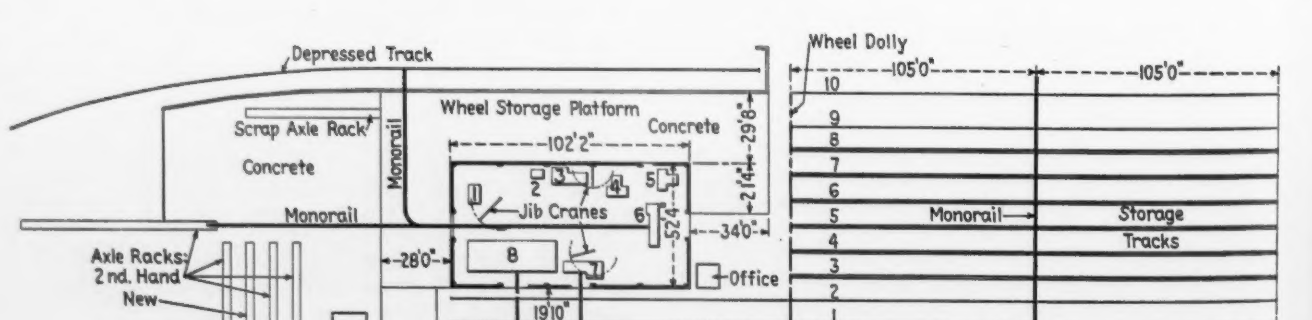


Looking through the shop from the north end. The overhead monorail extends through the building and out the south end.



Looking towards the shop from the northwest corner of the 10-track wheel storage area.

Missouri Pacific Wheel Shop at Houston



1—Bullard Cutmaster
2—Grinder
3—Axle lathe
4—Wheel boring mill
5—Wheel boring mill
6—Wheel press
7—Gap lathe
8—Wheel lathe

General layout of the shop and storage facilities

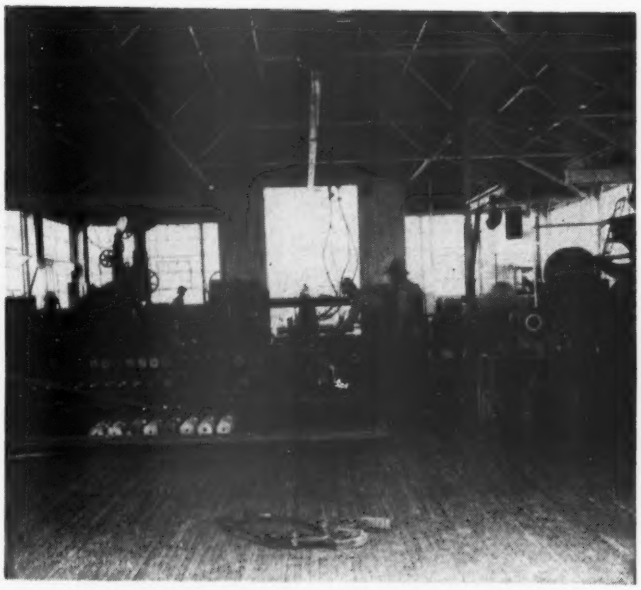
THE Missouri Pacific's new wheel shop at Settegast, Houston, Tex., has ample space for the storage and movement of materials and features an extensive monorail crane system for efficient material handling.

The shop and the storage facilities are laid out with the principal dimension running north and south, the north end of the shop building being the entrance end. Beginning at the extreme north end of the overall facilities. and working south, there are ten tracks leading toward the shop building for the storage and movement of mounted wheels. Seven of the tracks are 210 ft. long and terminate about 40 ft. north of the shop building. Two of the tracks extend past the north end of the building and run to the south end along the east side. The tenth track extends through to the center of the shop building. This building is 102 ft. long and 52 ft. wide. East of the building and the storage tracks is a 12-ft. concrete driveway running parallel to the tracks and the shop building, extending beyond the south end.

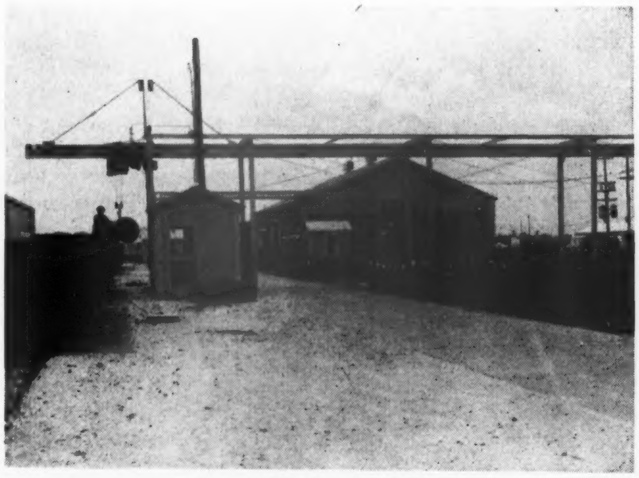
An extensive area around three sides of the shop is concreted to form a single large wheel storage platform. This extends outward from the north end 34 ft., and runs from the shop entrance to a line 29 ft. beyond the west side. The concreted area then runs southward at this depth beyond the west side to a line 28 ft. beyond the south end. The latter strip runs down along the south end as far as the east side. Another section of concrete joins this irregular shaped platform along the westernmost 50 ft., extending about 90 ft. to the south. The area below this latter extension is covered with gravel and contains axle racks and miscellaneous storage space.

Beyond the west edge of the concreted area is a depressed track for loading and unloading wheels from box cars and flat cars. This track begins at the northernmost end of the wheel storage platform and extends southward to connect with the yard trackage. Mounted wheels are delivered to or shipped from the shop on a wheel car track along the east limits of the repair facilities.

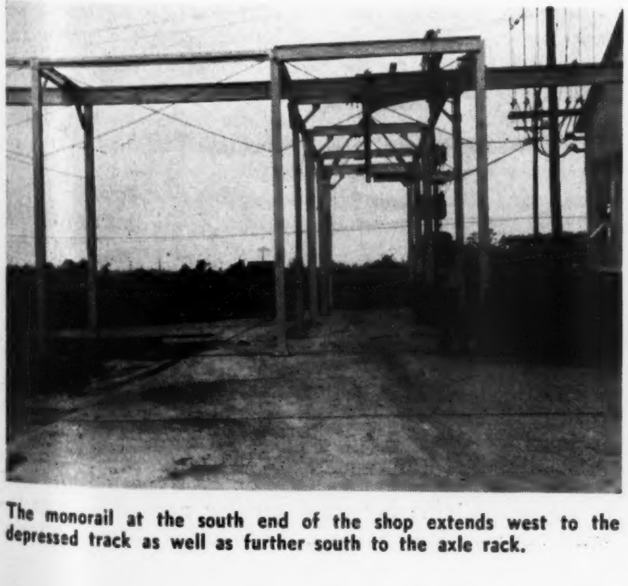
Four separate monorail systems are included in the layout. One extends from the track for receiving and delivering mounted wheels from wheel cars and crosses over all ten storage tracks. A second runs down the center of the shop building, beginning at a point over the wheel press just inside the north end; it extends on through the south end of the shop. Just outside the building, one branch turns west to the depressed wheel track 18 ft.



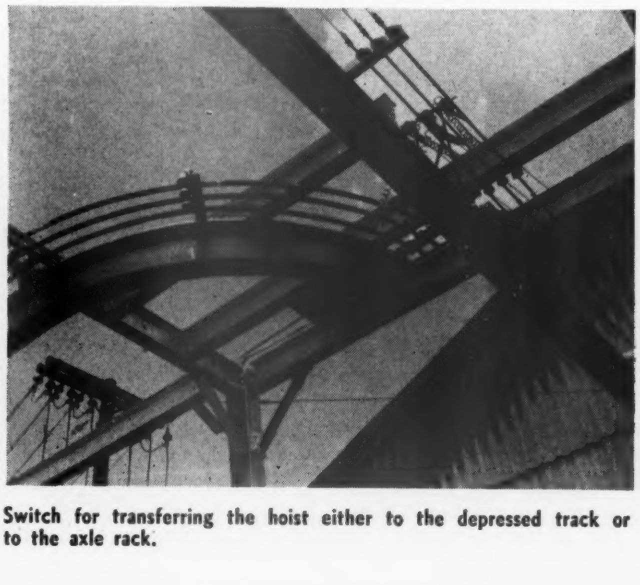
The shop as seen from the south end. A second-hand axle is being deposited on the rack in front of the axle lathe.



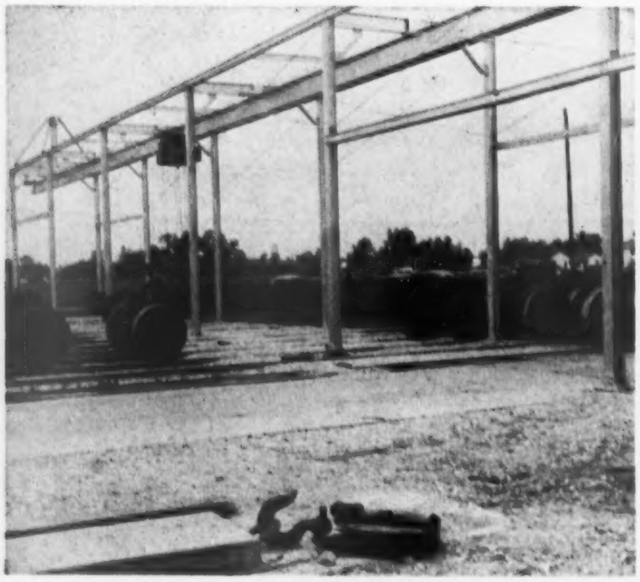
Mounted wheels are unloaded from the wheel car and transferred to the appropriate storage track by the monorail crane.



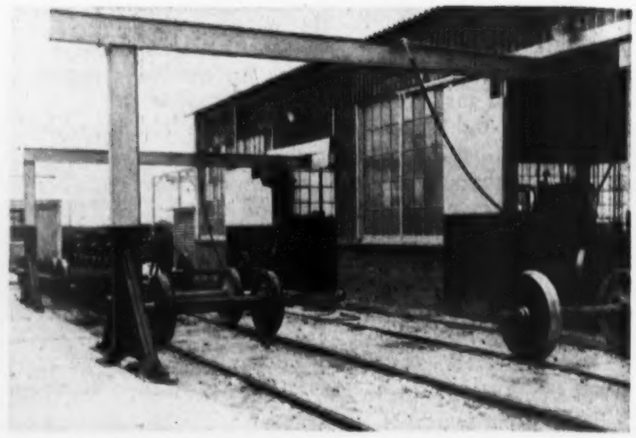
The monorail at the south end of the shop extends west to the depressed track as well as further south to the axle rack.



Switch for transferring the hoist either to the depressed track or to the axle rack.



The concrete drive-way in the foreground serves the rip track and can be used to by-pass full storage tracks.



The wheel lathe and the gap lathe are each served by an individual monorail which extends across Tracks 1 and 2

The wheel dolly comes close enough to the concrete drive-way to permit transfer of the wheels from the dolly to a lift truck.

beyond the south end. The other branch continues south to a large rack for second-hand axles. The remaining two monorails are short, extending across the two tracks along the east side of the building and running into the building to serve the wheel lathe and the gap lathe.

All hoists are electrically powered for both raising and movement, and all have a capacity of two tons with the exception of the hoist serving the wheel track and the storage tracks, which has a four-ton hoist. The monorail which runs down the center of the building and out to the depressed track has two hoists, while the remaining three have one hoist each.

Wheel Storage Tracks

The ten storage tracks north of the shop building are numbered one through ten from east to west. Tracks 1, 2, 9 and 10 are single tracks, while the six tracks in the center are double tracks.

Tracks 1 and 2 are for inbound steel wheels requiring turning. Track 3 is for 100,000-lb. OK wheels, either chilled cast or one-wear steel. Track 4 is for 80,000-lb. OK wheels of any type .Track 5 is for all types of bad order wheels except steel wheels which require turning or journal work.

Track 6 to 10, inclusive are primarily for OK wheels. Tracks 6 and 7 are for multiple-wear coach wheels while tracks 9 and 10 are for diesel wheels. Track 8 is a general storage and overflow track. It may contain either serviceable or defective wheels.

There are two methods of transferring wheels between the different storage tracks or from any one of the tracks to Track 5 for movement into the shops. The monorail crane serving the wheel car track and the ten storage tracks can pick up wheels from the wheel car and place them on any one of the storage tracks for further movement by hand rolling along the track. The second means of moving wheels between different storage tracks, but not to or from the wheel car track, is a small hand-operated four-wheel dolly running from Track 1 to Track 10 at the extreme south edge of the stub tracks. These two arrangements, plus the concrete drive-way between track 1 and the wheel car track, permits storage of wheels on any of the ten tracks on either side of the monorail without interfering seriously with easy movement.

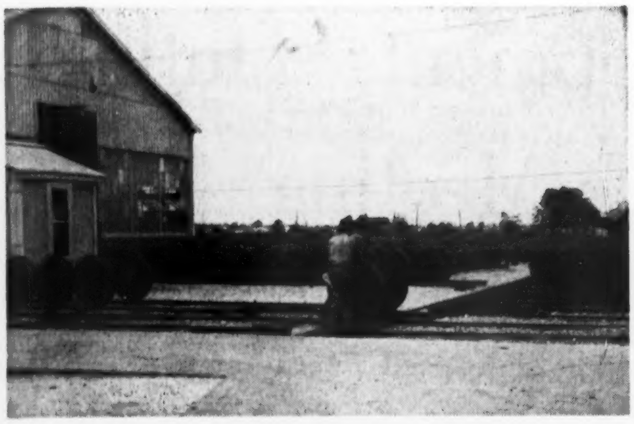
A good example of the alternate methods of movement available with this set-up can be shown by assuming that mounted wheels to be moved to the demounting press in the shops is north of the monorail on Track 8 (the general storage and overflow track). If there are wheels stored on track 8 south of the crane but Track 5 is clear from the crane to the dolly, the wheels can be rolled to the crane, moved by the crane to Track 5 and rolled in.

If Track 8 is clear south to the dolly, but track 5 has wheels on it, the wheels can be rolled to the dolly and carried to track 5 by the dolly for rolling into the shop. If tracks 5 and 8 are full south of the crane but another track is empty, the wheels can be rolled to the crane, moved by the crane to the empty track, rolled south on the empty track to the dolly and moved by the dolly to track 5 for rolling into the shop.

Finally, if all tracks are full south of the crane, the wheels can be moved by the crane to the concrete driveway by the monorail and then by shop tractor to the wheel press. In addition to its use as a by-pass for a full storage track, the concrete driveway is also used for truck movement of wheels to and from the rip track and for general shop service.

Movement Within the Shop

Wheels en route to the gap lathe for journal work or to the wheel lathe for tread turning normally move toward the machine on Track 2. Movement from the track



In addition to the monorail, a dolly can be used to transfer mounted wheels between tracks at the south end of the wheel storage area.

to the appropriate machine is by one of the short two-ton monorails, each of which serves one of the machines. Movement from the machine monorail crane back to storage is normally made on Track 1. Either track, however, can be and is used for movement in either direction when clear.

All bad-order wheels are placed on Track 5 initially for the foreman to determine disposition except where the defect is obvious enough for the unloader to determine. In such cases, the unloader places the wheels on the track and at the location to which it would ultimately be directed by the inspector. After sorting, all bad-order wheels, except steel wheels to be turned, are placed on Track 5 for movement into the shop. Those to be demounted are rolled into the shop by hand and on to the press without using the overhead monorail which runs lengthwise down the center of the shop building.

When wheels are demounted at the press the wheels generally are rolled away by hand while the axles are carried by the shop monorail. OK second-hand wheels are rolled by hand to the storage area immediately outside the door on the northeast section of the wheel storage platform. Scrap wheels are rolled directly from the demounting press to the car on the depressed track.

Second-hand axles are moved on the monorail to the area in front of the axle lathe which is along the west wall of the building in the approximate center. Any excess second-hand axles which cannot be accommodated in this area are carried by the monorail to one of the second-hand axle racks south or southeast of the shop building. Scrap axles also are handled by the monorail to the scrap axle rack located about 75 ft. southwest of the shop.

New cast-iron wheels are stored on the platform along the west wall of the shop from the north end toward the center of the platform. New steel wheels are stored toward the south end. The purpose of this arrangement is to have the cast wheels closer to the shop entrance as there are more of them. New diesel wheels and new passenger car wheels are stored in the same general area as the steel freight car wheels.

New wheels are rolled by hand either to the boring mill or to the storage area when they are delivered in a box car on the depressed track. When delivered in a flat car the wheels are moved directly to the boring mill on the monorail crane. Bored wheels to be mounted are rolled in by hand.

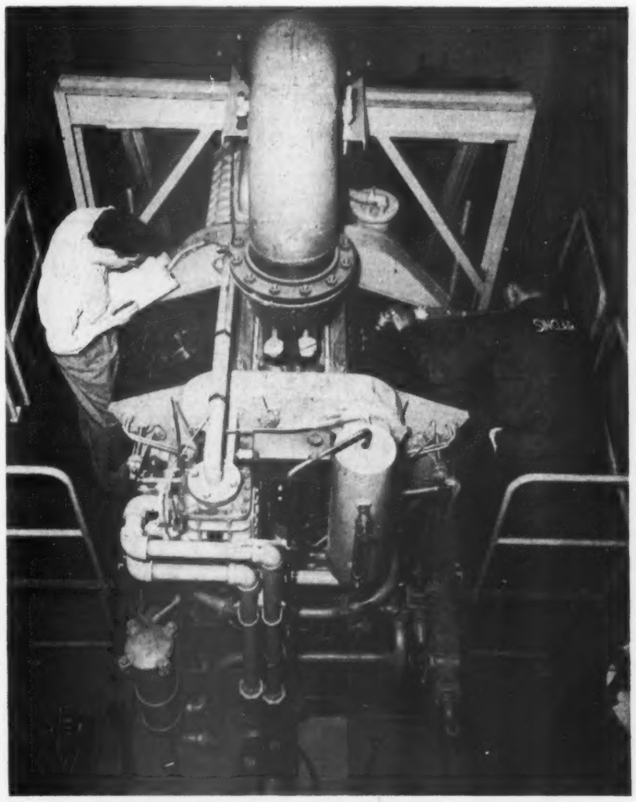
New axles are unloaded by the monorail and moved either to storage or to the mounting press. When mounted, the wheels are rolled to the dolly for distribution to the proper track.

Equipment in the Shop

The shop has eight principal machines. The wheel press is located at the north door. The wheel lathe and the gap lathe are located near the east wall and each is served by a monorail crane from the outside. The gap lathe is further served by a 12-ft. jib crane with a 1-ton hoist. Axles are inspected on a Magnaflux machine.

Two boring mills are located in the northwest corner. The one nearest the corner has a manual chuck and is used for steel wheels. The one further south has an automatic chuck and is used for cast iron wheels. The axle lathe is located to the south of the second boring mill and is served by the same type jib crane as the gap lathe, 1 ton with 18 ft. boom. This crane also serves the storage area for second-hand axles in front of the axle lathe. Just beyond the axle lathe is a 3 in. by 12 in. tool grinder.

The remaining machine is a Bullard Cutmaster recently purchased for boring and facing hubs of wheels already turned. It is served by a 12-ft. jib crane with a 2-ton hoist.



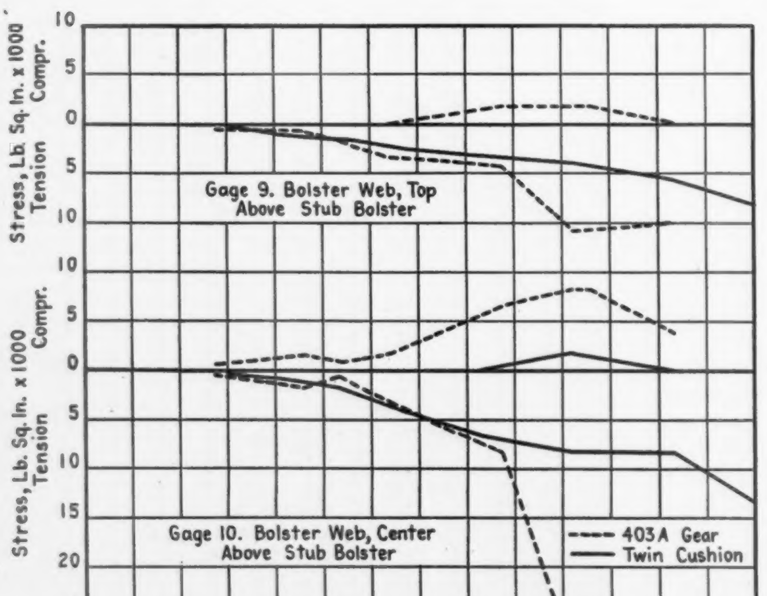
EMD 2-567B railway diesel engine recently installed in the Sinclair Research Laboratories at Harvey, Ill., for the testing and development of lubricating oils for heavy-duty service. With the exception of a shorter crankshaft and camshaft, more counterweights to eliminate vibrations, one blower instead of two, and one oil-filter cartridge instead of the usual four found on a locomotive, the engine uses standard locomotive parts in all locations. The fuel consumption is approximately 11½ gal. an hour at a rated speed and load of 800 r.p.m., 188 brake horsepower. Lubricating-oil capacity of the crankcase is 40 gal. and the water-jacket capacity 22 gal. Operating test periods range from 300 to 500 hrs. at 800 r.p.m. brake horsepower with elevated oil and water temperatures equal to the severest conditions encountered in railway service. The engine is being inspected at 100-hr. intervals, at which time samples of crankcase oil are removed and sent to the laboratory for analysis and spectrographic examination. The results thus obtained will be used as an indication of oil stability and engine condition. At the end of the test period the engine is to be disassembled and all parts inspected, rated and measured for wear. Jacket-water rust inhibitors are also being tested while the oil tests are in progress.

Draft Gear Developments Outlined At A.S.M.E. Meeting

Cincinnati symposium shows progress to date and added protection necessary in modern high-speed operation

With modern well-maintained draft gears and other cushioning devices adequate to afford protection at impact speeds only up to about four or at most 7 m.p.h., what happens to freight-car structures and lading when these switching speeds are exceeded in the ever increasing urge to get cars through yards with less delay? As a matter of fact, impact speeds up to 10 m.p.h. or more are by no means uncommon and all present indications point to increased rather than reduced speeds of switching in the future.

Railroads are therefore faced with the option of continuing to pay out large sums for lading and car damage, or spending a reasonable proportion of this money for shock-control equipment of higher capacity. In other words, the problem is now more economic than mechanical, since manufacturers are in a position to supply draft gears and cushioning devices with as much capacity as railroads are willing to pay for and provide the space to install. This thought was emphasized repeatedly at an important symposium on the subject sponsored by the Railroad Division at the recent semi-annual meeting of the A.S.M.E. at Cincinnati, Ohio.



Stresses in the body bolster web with Twin Cushion and friction draft gears at comparable impact speeds.

Rubber Draft Gears

One of the speakers, A. M. Bixby, vice-president, Waugh Equipment Company, traced the development of rubber draft gear from 1929, first in passenger service and then, in June 1940, in freight service, when five car sets of Twin-Cushion freight type draft gears were applied to General American stock cars.

The Twin Cushions in one of these stock cars have been periodically check tested by the A.A.R. under the 27,000-lb. hammer at the draft-gear laboratory at Purdue University. After nearly one year of service a 5.75-in. free fall of the 27,000-lb. tup produced a capacity of 18,760 ft. lb. After four years of service and approximately 25,000 miles, the same tup fall produced 19,912 ft. lb. capacity. After eight years of service and more than 500,000 car miles, the same tup fall produced 19,238 ft. lb. capacity. The gears are still in service and are scheduled for another check test this year, after 12 years of service.

In a check to determine the effect of extended periods of inactivity on the resilient properties of rubber, the A.A.R. found the capacity of the gear under a 5.25-in. tup fall was 18,100 ft. lb., as compared with a capacity of 18,200 ft. lb. for the new rubber, after a period of seven years stored in the A.A.R. laboratory, but subjected to a monthly laboratory calibration under the drop hammer throughout the period.

Another A.A.R. test to determine the effect

of inactivity in combination with normal weather conditions showed that after two years of inactivity under exposure conditions simulating that of a car stored on a siding a 5.5-in. free tup fall developed a capacity of 18,700 ft. lb., precisely the same as that developed at the beginning of the test.

Mr. Bixby also referred to the development of synthetic rubber for Twin Cushions during World War 2 which has shown no change of capacity after more than five years of service. He also described the results of low-temperature tests for brittleness of a new natural rubber compound in which it passed the minus 40 deg. and minus 70 deg. F. brittleness requirements and developed a lowest non-failure temperature of 75.4 deg. F.

A series of impact tests was conducted by a car builder with a 70-ton hopper car loaded to a rail weight of 204,460 lb. in 1948 to determine the stresses in various structural members. Gages were located at 50 stress points throughout the car which was tested with a Twin Cushion and a friction draft gear. One of the graphs summarizes the stresses in the body bolster. The gage at the center of the bolster web shows stresses increasing fairly proportionately with the Twin-Cushion gear to 14 m.p.h. The 10.2 m.p.h. impact caused the over-solid friction gear to stress the bolster nearly to the proportional limit, while the 10.6 m.p.h. impact caused the bolster to yield.

In closing, Mr. Bixby said that "rubber may be successfully used as a draft-gear medium, and that it will perform uniformly over at least a decade of service. Twin-Cushions will protect freight-car structure and lading under extreme operating conditions, and contribute to improved riding of passenger equipment."

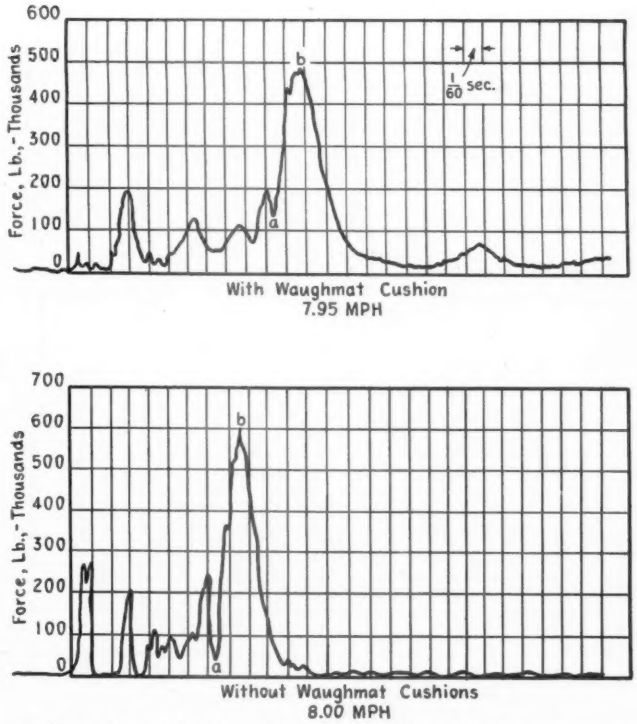
Cushioned Underframes

W. K. Durbon, vice-president, Hulson Company, reviewed briefly the history of the cushioned-underframe cars initially brought out in 1927 by the Duryea Corporation, which was merged with the Hulson Company early in 1950. A program was then undertaken to investigate the cushioning capacity required of cushioned underframe cars, coupler and body forces due to switching impacts, and static and dynamic laboratory testing of troublesome details, primarily of welded connections.

Tests were made at the impact testing plant of the Symington-Gould Corporation in June 1951 on two fully loaded box cars with a rail weight of 169,000 lb. of the single-spring underframe design. The struck car was equipped with an electric coupler dynamometer. The velocity of impact ranged from two to 10.25 miles per hour and was measured by the track chronograph. Two-way ride recorders were installed on the side sills near the bolster at the struck ends of the cars.

Three series of tests were conducted. In the first, one test car was impacted into a second. Both cars were equipped with Waughmat cushions and free to roll away after impact. In the second series the struck car was backed up with three cars. In the third, the Waughmat cushions were removed and all but ¾ in. slack taken up, making it equivalent to a standard single-spring Duryea car, and the first test repeated.

For under-solid blows the forces obtained at the coupler were in reasonable agreement with those obtained statically for the Duryea system. For impact speeds up to 5 m.p.h. the largest peak forces were 100,000 lb. which rose to about 775,000 lb. at 10.25 m.p.h. for cars equipped with the Waughmat cushions. Without the Waughmats the same force was reached at about 9 m.p.h. The initial coupler force due to the inertia of the sill plus



Oscillograph record of the forces developed in impact tests on cars with Duryea sliding center sills, with and without Waughmat cushion draft gears.

that required to overcome friction is substantially reduced by the Waughmat application. The greatest draft forces or tension on the coupler due to recoil were in the order of 100,000 lb. maximum, and, therefore, of little consequence.

In both cases shocks as shown by impact registers did not reach Zone 3, considered by many railroad men to be the beginning of the rough handling zone, until a coupling speed of about 7 m.p.h. was reached.

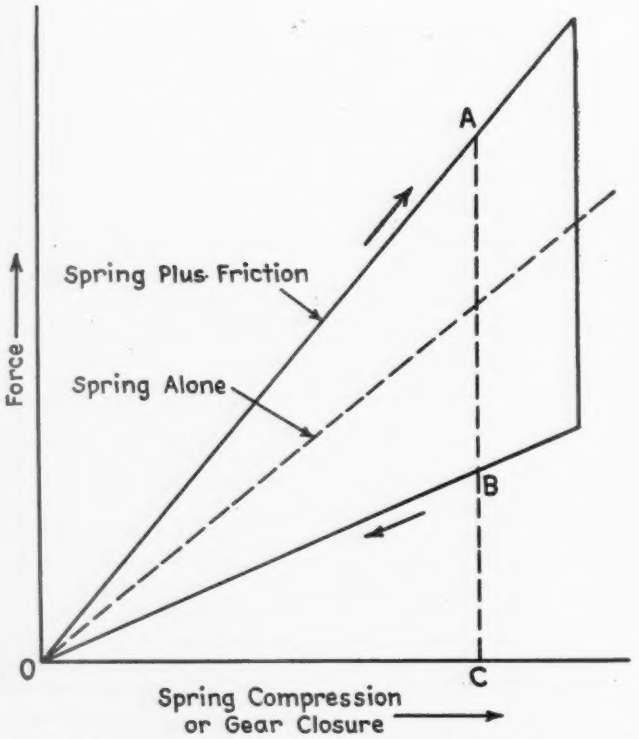
In the typical oscillograph record there is evident a difference in the degree of slope of the final force curve from *a* to *b*. This is the rate of change of acceleration. High forces at the coupler were developed in both cases, but there is not the sudden increase in the diagram showing the result with the Waughmat draft gears. The impact register in this case record was 0.85 in. Without the Waughmats, the record was 1.15 in.

The Depew tests of June 1951 clearly indicated that the capacities of the test cars were inadequate to handle cars and lading safety at coupling speeds of more than 7 m.p.h. During the past year studies of the Hulson Company indicate that capacities of 200,000 ft. lb. or more required to provide a margin of safety above the 7 m.p.h. limit are not only reasonable, but mechanically feasible.

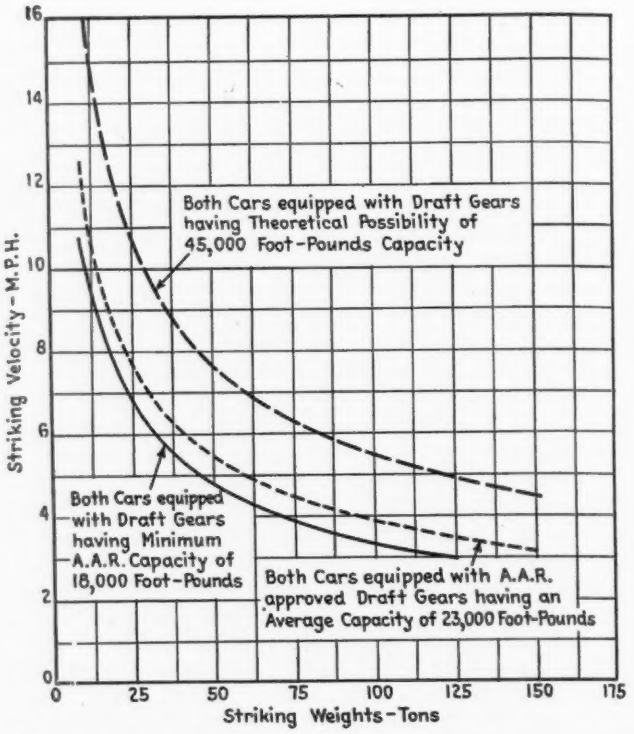
"Soundly engineering improvement in longitudinal cushioning of proper capacity provides a new means that can be used by the railroads to compete with other forms of transportation," said Mr. Durbon in closing. "Present classification yard schedules can be maintained, while damage to lading by impact can be controlled. The problem is not now mechanical, but rather one of economics."

Metallic Friction Draft Gears

The case for metallic friction draft gears was presented by N. T. Olsen, vice-president, Peerless Equipment Company, Chicago. The following is a condensation of his paper.



Simplified force-closure diagram assuming no initial compression and friction proportional to spring force



Effect of added draft-gear capacity in increasing the safe impact velocity.

The present A.A.R. requirements for draft-gear dimensions were determined by existing standards of car construction that at the time of their adoption had been in effect for about 26 years. These standards had also more or less influence on the limit set for draft gear travel, although in choosing these limits consideration was given to capacity that could be secured without exceeding a safe maximum pressure.

A change in draft gear pocket design, that is, more space in which to build the gear is not impossible; however, such previous requests have never met with favorable reception. A change of fundamental dimensions should not be made too hastily, but should be carefully analyzed so that it can be decided if such changes will encourage real improvement in design over the enormous number of approved friction gears now in service.

Several friction draft gears have been produced having travel up to 4 in., and the selective-travel gear incorporates a long travel in buff and a short travel in pull. The buff service is more severe than pull service and the longer buff travel permits greater buff capacity. Road tests with this draft gear, however, did not indicate any outstanding advantage occurring from its greater buff capacity when it came to reducing shocks incident to stopping trains under severe brake applications. The extra buff travel apparently created greater slack action in the train.

The present-day minimum A.A.R. requirements for capacity of a draft gear is 18,000 ft. lb. Presently we have nine fully approved draft gears that have met requirements of the A.A.R. specifications, and that have an average capacity of approximately 23,000 ft. lb. Utilizing the present maximum gear travel of 2¾ in. and a reaction starting at zero and building up in a straight diagonal line to 400,000 lb., which is considered a safe value for modern car construction, it is theoretically possible to secure about 45,000 ft. lb. capacity in a draft gear. If a draft gear that met the above conditions and also retained other desirable characteristics, such as freedom from sticking, low recoil, satisfactory endurance, sturdiness and life, and could be economically produced, a considerable increase in car protection would be afforded.

From the curves of striking weights vs. impact velocities, it can be seen that for a striking weight of 50 tons, the safe colliding speed for 18,000 ft. lb. capacity gears is 4.82 m.p.h.; for 23,000 ft. lb. capacity gears is 5.42 m.p.h.; and for the 45,000-ft.-lb.-capacity theoretical gear is 7.61 m.p.h. The latter speed is an increase of 40.3 per cent over the average of the presently approved nine draft gears.

Just recently the U.S. Navy requested quotations on friction draft gears, specifying that manufacturers guarantee that no damage to car structure or contained parts will result in impact speeds at 10 m.p.h. for a special type car weighing about 86 tons. Checking the curves for a car of such weight, indicates that the present average approved draft gears will safely take impacts at about 4.25 m.p.h., or approximately 42.25 per cent of that requested by the Navy.

Draft gears could easily be designed that would afford protection at higher impact speeds in classification yards, but then their protective value in train operation would be less because of their stiffer action. It is generally claimed, that the majority of the damage to car and lading occurs in the classification yard due to impact speeds beyond the capacity of the friction draft gear, but it is entirely possible there may be even more damage in train operation if the draft gears were too stiff for such service. At least, impact speeds in a classification yard can be controlled somewhat, but to control the action in train operation is very difficult.

It should be remembered that a draft gear's ability to absorb energy depends on the forces developed and the distance through which these forces are permitted to act. Conversely, for a given energy absorption the average forces vary inversely as the amount of relative motion between the acting bodies during impact. It would seem

then that as long as draft-gear manufacturers are limited to the present travel of 2¾ in., and the necessity for keeping forces developed during impact at a minimum, future improvements in metallic friction draft gears will lie in better distribution of the force of impact throughout the draft-gear cycle.

During World War II great advances were made in a simple and accurate technique of measuring rapidly varying forces by use of the resistance type electric strain gage. One of the draft gear manufacturers, becoming familiar with this technique in working on practical ordnance problems, suggested its use for measuring draft gear forces under a drop hammer. The manufacturer, in the interest of improving the art of draft gear testing, sponsored a development test at the A. A. R. laboratory at Purdue University in order to determine suitable equipment for direct measurement of gear forces.

The equipment used to obtain force-time records in this program consisted of SR-4 wire strain gages mounted on four steel cylinders as the force pick-up unit, a potentiometer-type strain circuit, a cathode ray oscillograph and a rotating drum camera.

Three of the sponsoring manufacturer's draft gears having different characteristics were tested in this program, using the above-mentioned equipment. The results obtained were quite promising, and a complete report of the findings was furnished to the A. A. R. Draft Gear Sub-Committee, and later to the other draft-gear manufacturers. At the suggestion of the sub-committee, all of the friction draft-gear manufacturers submitted their gears to be tested by this method, and the results have been published in the A. A. R. Draft-Gear Testing Laboratory Report dated January 15, 1951.

It is quite possible that a very simple and highly accurate method of determining forces set up in a draft gear during closure will be developed, and then the designer will be better able to determine the force-closure characteristics of a gear which in all probability will result in draft gears of higher capacity while still retaining low terminal forces and other desirable characteristics.

Still another factor that has greatly handicapped the draft gear designer is the lack of sufficient knowledge concerning the work required of a draft gear in modern train operation and its relation to laboratory characteristics of a draft gear. It is entirely possible that a gear may show high reaction and erratic action in the laboratory, but will lose these undesirable characteristics when placed under a car. The presence of rust on the friction surfaces, so common in actual service and absent in a laboratory, no doubt, tends to reduce the coefficient of friction between the sliding surfaces which in itself will tend to smooth out gear action. Then again, due to the resiliency of the car structure, forces set up during draft gear closure may be considerably less in actual service than in the laboratory.

Before any correlation between laboratory and service performance of a draft gear could be made, an extensive series of tests, both laboratory and service, would have to be made using all of the modern testing equipment. available. Such program would be rather expensive and would require careful analysis to draw any satisfactory conclusions. However, if the desired information could be obtained from such a test, its aid to draft gear designers would be invaluable in their efforts to further develop draft gears that are so vitally needed on railroads today.

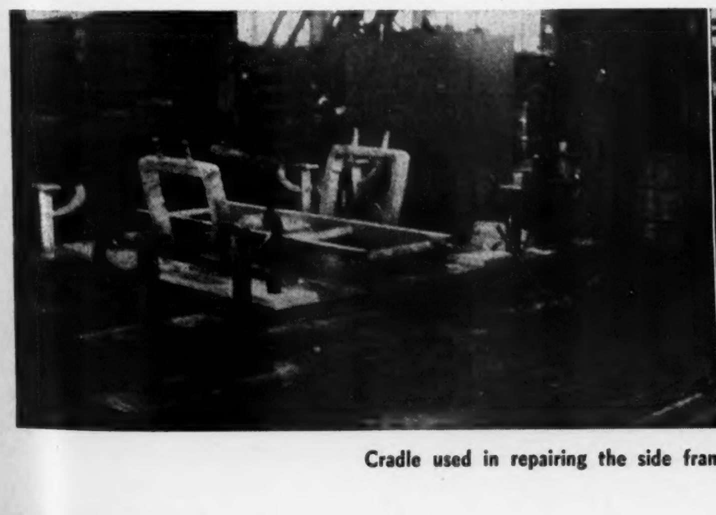
Repairing Alco Three-Piece Trucks

A cradle device used in repairing the side frames of Alco three-piece trucks has been developed at the San Bernardino shops of the Santa Fe, as shown in the illustrations.

After the truck is stripped, parts are cleaned and inspected and defective parts marked for handling. The side frame is placed in the cradle, the top half being bolted in place. The cradle thus forms a trunnion resting on four flanged wheels which are mounted on two shafts that turn in Timken bearings.

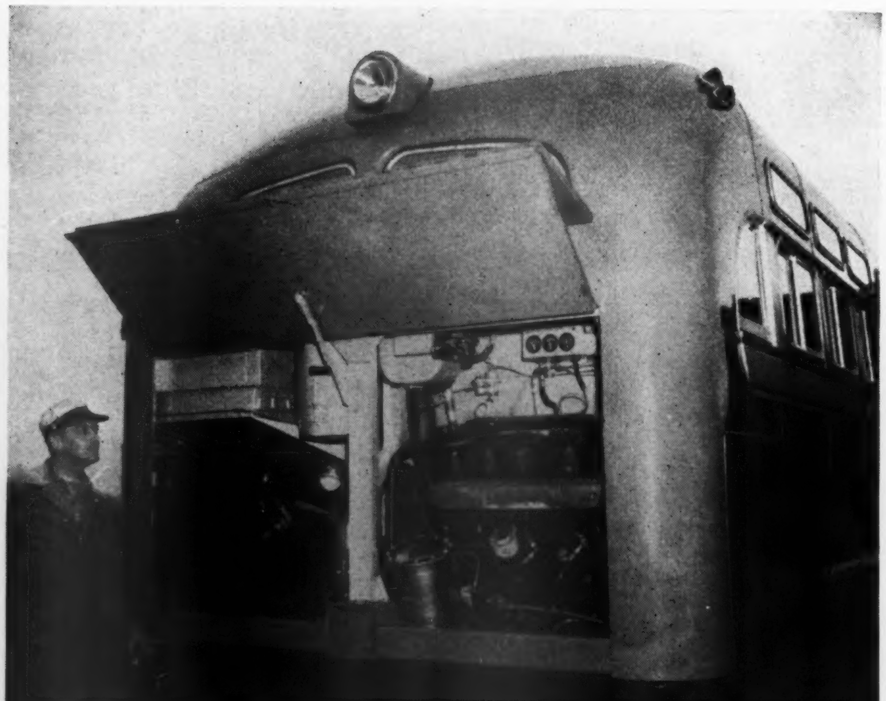
One side of the trunnion has a fabricated gear. An air motor drives a chain of worm and spur gears that mesh in this fabricated gear and rotate the cradle and the side frame through 360 deg. This allows the side frame to be turned to any desired position, at which a latch holds it in place, enabling the mechanic to perform all work while standing upright.

After all parts have been repaired and replaced, the side frame is rotated to the proper position for placing it on the wheels. The top half of the cradle is removed, enabling side frame to be lifted out and placed on wheels.



Cradle used in repairing the side frames of Alco 3-piece trucks

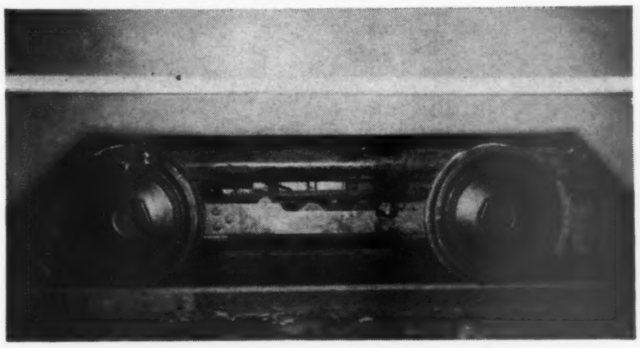
New Haven Tries New Rail Car



The power plant is cross mounted at the rear.


General lighting is furnished by two continuous rows of fixtures.


The seat at the rear is full width.


Resilient steel wheels insure quiet operation.

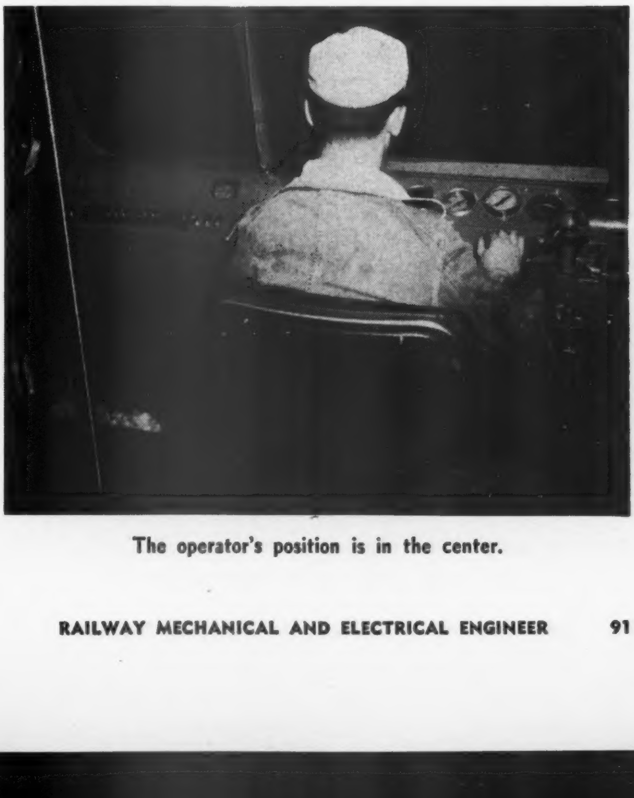
A DIESEL-electric rail car, known as the Mack FCD rail bus, designed to provide a means of handling light branch-line service economically for many railroads, is now in service on the New York, New Haven & Hartford.

Built by the Mack Manufacturing Corporation and equipped by General Electric, the car operates on a 17-mile stretch between Mansfield, Taunton and Fall River, Mass.

The car is an adaptation of the 50-passenger Mack bus used in New York City. It has a power plant consisting of a Mack 220-hp. supercharged diesel engine directly connected to a G.E. generator which, in turn, drives four 55-hp. G.E. traction motors.

The chassis is mounted on two four-wheel P.C.C. car trucks with one motor driving each of the four axles. Coil and rubber springing in the truck suspension, resilient steel wheels, hypoid motor gearing and resilient mountings for motors provide smooth and quiet riding and a high degree of rider comfort.

The car, which makes three round trips a day on each run, offers passenger service where none has been provided for the past 20 years. Since the service was initiated, the car has carried some 170 to 180 riders per day.


The operator's position is in the center.

How To Tonnage-Rate Diesels into a Few Groups*

By E. H. Weston†

While the problem of matching locomotives with trains according to tonnage is essentially one ultimately handled by the transportation rather than the mechanical department, there are means by which railway mechanical and electrical engineers can render valuable assistance by establishing scientifically a few tonnage rating groups into which will fall a large variety of makes and models of diesel locomotives.

In addition to the many varied types of main-line diesel road freight locomotives currently being operated, each year more special low-axle loading machines suitable for light rail and light track structures are announced. The six-axle, six-motor type of 1,600-hp. road switcher with a total weight around 290,000 lb. is the outstanding example of a current type of branch line locomotive.

These same six-axle, six-motor road switchers are also being ballasted to 360,000 lb. for heavy main-line drag service at low speed. In other cases, two or three 1,000-hp. switching locomotives with special gear ratios are being multipled for special heavy line drag service.

The impact of all these types of diesels on the railroads has resulted in no little confusion as to just which type is suitable for a specific service. Since railroad purchases of diesel power have for the most part been made slowly at first and then more rapidly, each railroad may have a number of different models of the same general type of locomotive from the same manufacturer. To add to the complexity of the situation, the operating people are given to understand that certain of these locomotives of the same horsepower cannot operate together in multiple on the same train because of differences in electrical equipment.

On many railroads there still is not a clear conception of the relationship of maintenance and operating expenses of diesel motive power as against the gross ton miles per freight train hour produced. The result is that on any given railroad the polyglot population of diesel locomotives are constantly being shifted from division to division in an effort to secure better utilization. If system timetables must patiently spell out tonnage ratings for every type of diesel by number for every subdivision, timetables will soon attain undue proportions and complexities.

The problem of tonnage-rating all the various types and makes of diesels for all sub-divisions of all divisions is a formidable task. Some means must be found to tonnage rate these machines quickly and safely with special emphasis on added train costs arising from stalling and doubling hills or simply overloading and damaging the electrical equipment.

In some cases tonnage ratings can be superseded by special agreements stating the duties a certain road job must encompass. Here switching moves and time on the road are the ruling considerations. Most train movements, however, are based simply on the principle of getting the greatest possible movement of tonnage per motive power unit.

Railway mechanical and electrical engineers can help in simplifying the tonnage rating situation. Ways and means do exist by which certain common denominators of performance can be developed for all types and makes of diesel locomotives. When a tonnage rating for a diesel is under consideration it is only natural to think of engine speeds near or at the continuous rating speeds of the traction motors. If the ruling grade is not too long, it may be that the tonnage rating is associated with a pulling force and speed slightly below continuous rating. In such a case engine weight on the drivers and limit of rail adhesion may be the common limiting factor of tractive force rather than electrical overloading.

These facts are indicated by the diagram in Fig. 1 which shows, first, the typical hyperbolic trace of attractive force-speed curve of a diesel electric locomotive and, second, the depressing effect of rail adhesion on the tractive force curve in the speed ranges below continuous speed.

The starting tractive force of the diesel electric locomotive set forth in Fig. 1, is assumed to be limited by a factor of adhesion of .25, or 25 per cent of the weight on driving wheels. This starting tractive force is further assumed to remain constant until a speed of 5 m.p.h. is approached. As the speed of the locomotive increases beyond 5 m.p.h., there is a very rapid deterioration in the factor of adhesion. The factor of adhesion drops as

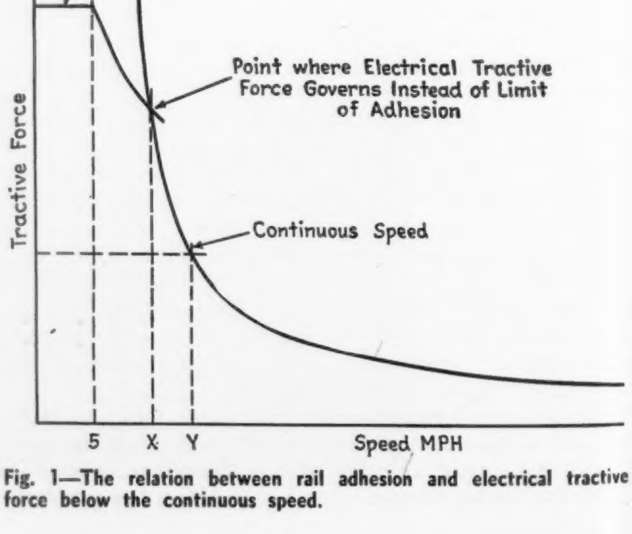


Fig. 1—The relation between rail adhesion and electrical tractive force below the continuous speed.

*Abstract of a paper presented at the A.S.M.E. semi-annual meeting June 15-
† Assistant chief mechanical engineer, Chicago and North Western.

the speed of the locomotive increases, but beyond about 10 m.p.h. the rate of decline in the factor of adhesion begins to moderate.

Generally in the vicinity of 8 to 10 m.p.h., the tractive force line representing the limit of rail adhesion of the locomotive drivers crosses the hyperbolic curve of electrical tractive force. The point of intersection of the curve representing the limiting value of rail adhesion and the curve of the electrical pulling force of the traction motors is indicated on Fig. 1 by the second vertical dotted line from the ordinate which intersects the abscissa at "X" miles per hour.

Thus, "X" m.p.h. in the case shown is the point where the electrical tractive force of the locomotive's motors limits the pulling effort of the machine instead of the limit of rail adhesion. At speeds greater than "X" m.p.h., the effective tractive force of the locomotive is truly represented by the typical tractive force curve published by the manufacturer.

In Table 1 are illustrated five types of diesel electric locomotives wit hthe weight on drivers of the five makes of machines varying from 233,000 to 287,000 lb. Locomotives A, B and C are of the four-axle, four-motor type, D and E are six-axle, six-motor type. The starting tractive force of each is limited to 25 per cent of the respective weights on the drivers and varies from 58,250 to 71,750 lb.

Column 4 indicates the maximum speed up to which the starting tractive forces act. Column 5 indicates the speeds at which the tractive force limited by adhesion equals the electrical tractive force of the traction motors. These speeds in Column 5 correspond to speed "X" miles per hour in Fig. 1. Column 6 states the continuous rated speed of each unit, and Column 7 states the tractive force associated with each continuous speed.

In lines D and E and in Column 5 the balance point of tractive force limited by rail adhesion and tractive force limited by the power of the traction motors occurs at a speed greater than the continuous speeds for the two locomotives as stated in Column 6. This is typical of most six-axle, six-motor machines weighing about 285,000 lb. on the drivers. For locomotives D and E in Table 1, the limit of adhesion fixes the maximum pulling force for all speeds up to and through the continuous rating speed; the machines designated D and E, will slip down on a grade before they will overload the traction motors.

Table 2 restates the designations of the five types of locomotives with Columns 1, 2 and 3 carried over from Table 1. Here column 4 indicates the basis on which the loading of the five types of machines being compared is estimated. The resistance in pounds per ton of car weight are based on a car weight of 50 tons gross load moving at the respective continuous speeds of each locomotive and traveling up a .77 per cent grade. The .77 per cent grade figure was selected because it was the best average ruling grade condition of all C&NW divisions radiating out of Chicago.

In Column 5 is shown the result of dividing the continuous tractive forces for each type of machine by the respective train resistances. The total train tonnages shown in Column 5 represent train consist that each locomotive could be expected to start from rest on flat and level track and to handle over various divisions around Chicago.

Columns 6 and 7 state the calculated elapsed time and distance needed by each of the five selected locomotives to arrive at their respective continuous speds on flat and level track when handling the tonnage indicated in Column 5.

TABLE 1—CHARACTERISTICS OF THE THREE FOUR-MOTOR AND TWO SIX-MOTOR DIESEL-ELECTRIC UNITS

1		2	3	5	6	7
Loco. type	Wt. on drivers, lb.	Start. tr. force 25 per cent adh., lb.	Start. tr. force acts at max. speed, m.p.h.	Elec. tr. force-adh., m.p.h.	Cont. speed, m.p.h.	Cont. tr. force lb.
A	250,000	62,000	5	8½	10½	42,500
B	255,000	63,750	5	9	11	40,000
C	233,000	58,250	5	10	11	40,000
D	278,900	69,700	5	9	7½	59,000*
E	287,000	71,750	5	8	7¼	61,500*

* Limited by adhesion.

TABLE 2—TIME AND DISTANCE TO ACCELERATE TO CONTINUOUS SPEED WITH RATED TONNAGE

1	2	3	4	5	6	7
					Accel. from rest to cont. speed	
Loco. type	Cont. speed, m.p.h.	Cont. tr. force, lb.	Train resis.* .77 per cent grade, cont. sp'd, lb. per ton	Cont. speed train on .77 per cent grade, tons	Time, sec.	Distance, ft.
A	10½	42,500	19.40	2,190	48	420
B	11	40,000	19.40	2,060	44	385
C	11	40,000	19.40	2,060	48	416
D	7½	59,000†	19.20	3,070	40	221
E	7¼	61,500†	19.25	3,200	39	208

* 50-to cars.
† Limited by adhesion.

From an examination of Columns 6 and 7 in Table 2, it is evident that locomotives A, B and C perform quite differently in the handling of their respective trains than do locomotives D and E.

Selecting Criterion Unit

Forgetting, for a moment, the specific train tonnages shown for each locomotive in Column 5 and just remembering that each of the five types of locomotives *is loaded in the same degree,* it is evident that for speeds from zero ton continuous, certain of the machines in Table 2 will group up as far as train performance is concerned. In setting up the grouping on the basis of diesel locomotive performance figures as set forth in Columns 6 and 7, it is recommended that only these locomotives whose acceleration times and distances from

TABLE 3 — THE CRITERION UNIT IS DETERMINED BY AVERAGING THE TIMES AND DISTANCES OF ALL UNITS IN EACH GROUP

Loco. type	Cont. speed, m.p.h.	Cont. speed train on .77 per cent grade, tons	Accel. from rest to cont. speed: Time, sec.	Accel. from rest to cont. speed: Distance, ft.	
A	10½	2,190	48	420	Group I units
B	11	2,060	44	385	
C	11	2,060	48	416	
	Average.......		46	407	
D	7½	3,070	40	221	Group II units
E*	7¼	3,200	39	208	
	Average.......		39.5	214	

* Criterion unit.

rest that can be contained within a range of 10 per cent from minimum to maximum be used as the basis for grouping.

Table 3 is a partial restatement of Table 2, but goes one step further in showing averages of train performance data for each of the two groups of locomotives. In the case of locomotives A, B and C, designated as Group 1 units, the averages of the three values of acceleration times and distances indicate that B is the criterion unit of the group.

In the case of D and E the averages of accelerating times and distances would not positively indicate which machine might be representative of that group. In this case the criterion unit might simply be selected on the basis of the number of each type owned by the railroad.

The method outlined in Tables 2 and 3 for grouping various types of diesel units is an attempt to average out locomotive performance facts in the speed ranges where tonnage ratings are generally determined. However, if a tonnage rating subsequently developed for the criterion engine in any group so selected and grouped on any ruling grade is applied to each of the other engines in the group, the resulting data on time over the hill and time running at continuous speed or below will not vary among any of the engines in the group by more than 12 per cent.

It is also a fact that using the criterion unit's tonnage rating for a group of locomotives will result in train performance statistics at speeds above continuous rating that will be almost identical for all machines in the group. In other words, to use the tonnage rating for a certain division as developed from a given criterion unit that was picked from a group of locomotives analyzed per above, will result in almost identical values of gross ton miles per freight train hour for all machines in the group.

Performance on Ruling Grades

After determining which one of a group of locomotives is to be the criterion machine of the group, it will, of course, be advisable to consider a certain ruling grade and develop a group tonnage rating for the grade. Fig.

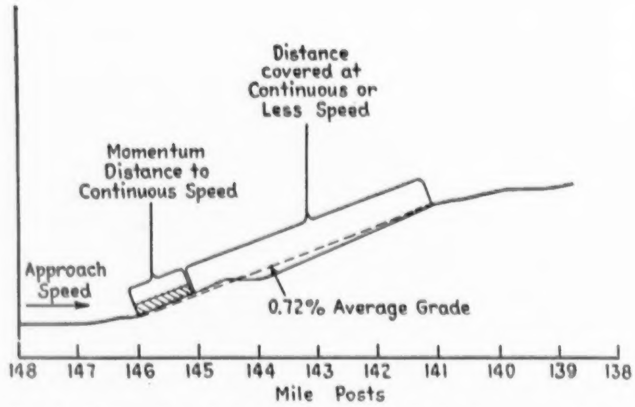


Fig. 2—The grade selected for determining the tonnage rating of the criterion units.

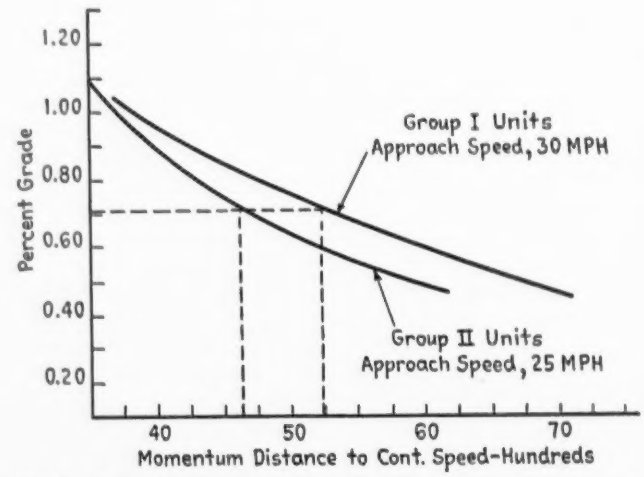


Fig. 3—Curve for determining the distance during which the train slows from approach speed to continuous speed.

2 indicates a typical grade over which tonnage ratings for each criterion units may be developed. The average grade is .72 per cent and it is approximately five miles, or 25,000 feet long.

Each criterion unit and train will approach the grade from the left at a certain speed. As the locomotive and train start up the hill, the momentum of the train will assist the locomotive in overcoming the initial effects of the grade for a short distance. Since the combination of grade resistance and speed resistance of the freight train cars is generally greater than the locomotive tractive force at speeds above continuous, the train speed decreases steadily as the train moves up the grade, until it eventually slows down to the continuous rating speed of the traction motors. The distance the locomotive and train run up the grade while at the same time slowing down from the approach speed to continuous speed is shown as a bracketed line labeled "momentum distance to continuous speed."

The remaining distance of the grade beyond this first bracketed length is that part of the grade that the locomotive and train will negotiate at the continuous speed of the locomotive or less, depending on the tonnage and on the steepness of the grade.

Fig. 3 suggests how the "momentum distance to continuous speed," might be quickly found. For each criterion engine in Group 1 or Group 2, a number of calculations were made, working backwards from certain

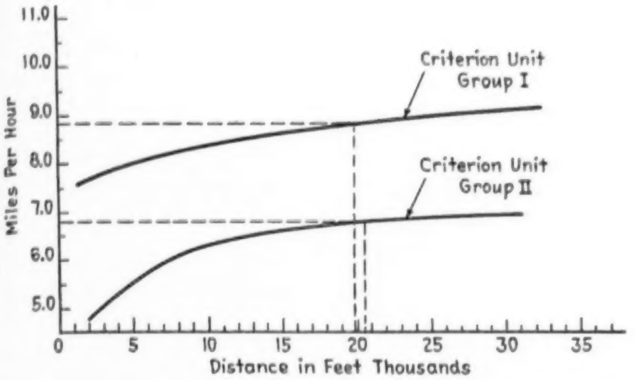


Fig. 4—Short-time traction motor ratings, showing the distances that can be safely covered at each speed.

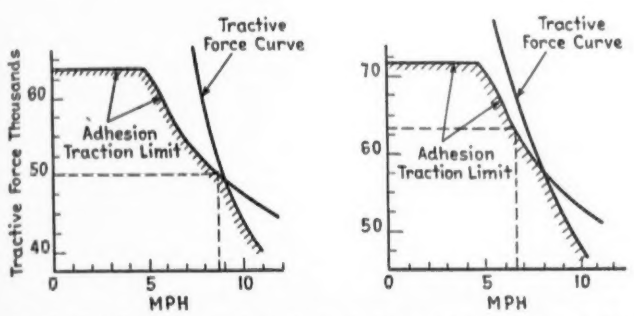


Fig. 5—Detailed low-speed portions of the tractive force curves for the two criterion units.

train tonnages and given ruling grades to develop the data for each graphed line shown.

Fig. 3 is based on an approach speed of 30 m.p.h. for the Group 1 machines and 25 m.p.h. for the Group 2 machines. Outside of considerations for special slow orders or signals at the foot of certain grades that would require a train coming to a full stop, the approach speeds and resulting distances to slow to continuous speed for the various per cent of grades shown, are felt to be representative of average road conditions.

The Speed of Each Unit

Fig. 2 shows that the average value of the ruling grade under consideration was .72 per cent. Looking up the ordinate axis of Fig. 3 to .72 per cent and reading across to each of the group lines, it develops that Group 1 machines with their trains will slow from 30 m.p.h. to 11 m.p.h. on a .72 per cent grade in 5,200 feet, whereas Group 2 locomotives and trains will slow from 25 m.p.h. to 7¼ m.p.h. on the same .72 per cent grade in 4,600 ft.

Fig. 4 is a graph of the short time ratings of the traction motors for the criterion engines in Group 1 and Group 2. The data in Fig. 4 are generally supplied by the manufacturer in tabular form, but were put into the form shown by simply reading distance into the manufacturer's declaration of speed and allowable time in the overload zone. The closer the speed of the locomotive approaches its continuous speed, the greater the distance the locomotive will be permitted to run at that speed.

Going back to the problem in hand, from a consideration of the grade on Fig. 2 and the "momentum distance to continuous speed" found in Fig. 3 Group 1 locomotives will negotiate 19,800 ft., and Group 2 20,400 ft., of the grade at continuous speed or less. Reading up to the short time rating curve on Fig. 4 for each criterion engine, he finds that Group 1 units cannot travel slower than 8.8 m.p.h. and that Group 2 units cannot travel slower than 6.8 m.p.h. in traversing this grade.

TABLE 4—HOW THE TOTAL TONNAGE AND ALLOWABLE CONTINUOUS GRADE AT CONTINUOUS SPEED ARE COMPUTED

Line No.		Group I units	Group II units
1.	Length of initial average grade, ft.	25,000	25,000
2.	Momentum distance on .72 per cent grade Fig. 3, ft.	5,200	4,600
3.	Net length of grade at continuous or less speed, ft.	19,000	20,400
4.	From Fig. 4, minimum locomotive speed, m.p.h.	8.8	6.8
5.	From Fig. 5 and Line 4: maximum tractive force, lb.	50,000	63,500
6.	Train resistance* per .72 per cent grade: speeds per Line 4, lb. per ton	18.30	18.20
7.	Maximum tonnage rating, Line 5 ÷ Line 6, tons	2,730	3,490
8.	Net trailing tons (Line 7 minus engine weight), tons	2,603	3,347
9.	Practical limit of trailing tons (90 per cent of Line 8) tons	2,340	3,010
10.	Continuous grade of continuous speed, per cent	.61	.78

Based on 50-ton cars.

Having determined the minimum operating speed for each criterion unit for negotiating the ruling grade without exceeding the short time ratings of the traction motors, the maximum pulling force each criterion unit will develop at these maximum speeds is considered.

Fig. 5 details the low-speed portion of the tractive force curves of the two criterion units. Superimposed on these tractive force curves are the respective limits of pulling force due to rail adhesion for each criterion unit.

The minimum speed of 8.8 m.p.h. on the ruling grade as calculated above is indicated and a vertical line is erected to the tractive force curve. For the case of the Group 1 machines the pulling force is 50,000 lb. and is limited by rail adhesion.

When the minimum speed point of 6.8 m.p.h. for Group 2 machines is found on the tractive force curve, a pulling force of 63,500 lb. results, limited again by rail adhesion.

From tables of car resistance at the minimum speeds for each of the criterion units plus the equivalent resistance of grade, a total figure of train resistance is found. Dividing the total train resistance figure for each group of units into the respective maximum pulling forces gives the total train tonnage that can be moved over the grade without exceeding the short time ratings of the motors or exceeding the limits of rail adhesion.

Determining Rated Tonnage

Table 4 outlines how the above calculations and graph readings might be handled to arrive at the total train tonnage. Line 7 indicates the total train tonnage for each group of machines. Line 9 suggests that 90 per cent of the maximum train tonnage figured above be used for the published tonnage rating. The 10 per cent cut from the calculated maximum tonnage allows for uneven track conditions that might further depreciate the rail adhesion factors; for the effect of wind on a broken consist train; for a possible high proportion of empty cars to loaded cars, thus increasing temporarily the specific train resistance per ton of weight; and finally for the fact that the mechanical and electrical condition of all freight diesel electric locomotives is not always up to standard.

Line 9 then indicates the practical limit of train tonnage that may safely be handled by all Group 1 and Group 2 locomotives.

Line 10 develops an interesting point. If each criterion engine were loaded down with the train tonnage outlined in Line 8 and then run at full power at its continuous speed, it would be able to negotiate a certain grade for an indefinite time. The per cent of grade over

which this indefinite period of operation would result is indicated in Line 10.

A re-examination of the track profile for the division over which the above tonnage rating was determined, might then be made to see just where and by what amount any other grade on the division might exceed this continuous speed grade. A check can thus be made on the original selection of the ruling grade for the division. Perhaps another spot will turn up where the criterion machine will go into its short time rating. But with a set of critical distances and speeds already worked out for a given train tonnage, the new grade condition can be quickly judged as to importance.

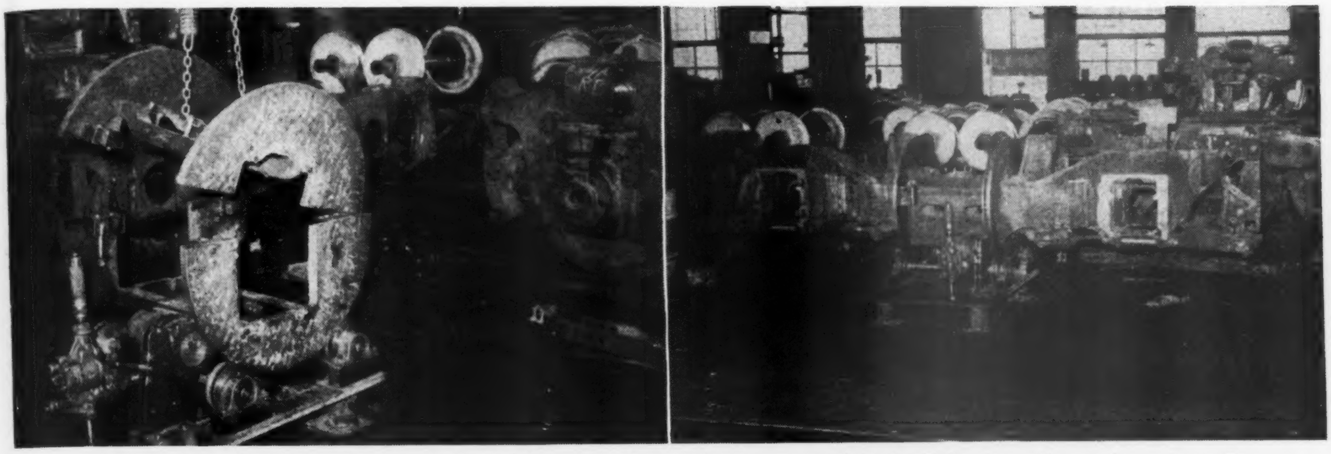
Aside from the advantage of being able to examine quickly the effect of various grades on a division on a large group of locomotives, other questions can be answered with equal ease. For instance, the shorter the ruling grade over which a tonnage rating calculation is carried, degree of grade being equal, the heavier the locomotive may be loaded. In other words, the effect of train momentum is relatively more important in rating a locomotive on a short grade because the remaining distance the locomotive must run to clear the crest of the hill is much shorter and hence the locomotive can safely dip more deeply into the short time rating of its traction motors. From the particular grade condition in hand, plus a consideration of Figs. 3 and 4, allowance may be made for the shorter grade with a lesser full load locomotive speed assigned thus giving a higher short time tractive force.

From the practical standpoint the indicated method of grouping diesel locomotives, where formal tonnage tests do not exist, can assist in arriving at general agreements with the operating people while at the same time allowing the machines to be worked to a safe maximum.

Further, a system of grouping diesel-electric locomotives on an equal performance basis simplifies the selection of engines to be multipled together. A method of grouping diesel units into tonnage rating groups regardless of manufacturer, model, weight on drivers, or continuous speed, is valuable in selecting those that might evenly share train load when working together.

Finally, if it occasionally becomes necessary to mix diesel units of two different groups together on a train, a system of grouping would immediately indicate that the lowest group rating machine should lead the train and that the train tonnage should be only multiples of the rating of the lowest unit.

Two diesel locomotives recently turned out at the Beloit Works of Fairbanks, Morse & Co. The larger, one of two twin units, was built to haul the New York Central streamliner, James Whitcomb Riley, between Chicago and Cincinnati. The smaller unit was delivered to the Milwaukee for switching cars in one of the system's freight yards. Eight of the big C-line passenger units, powered by 2400-hp. opposed-piston engines, were delivered to the NYC in March, and twelve C-line freight locomotives to this railroad during the first quarter of 1952. The switcher is powered by a 1200-hp. opposed-piston engine.



EMD truck-repair stand (left) empty and (right) supporting truck at a convenient level for inspection and repair work.

Truck Lifting Device And Repair Stand

The illustrations show a truck-lifting device and a repair stand successfully used in reconditioning EMD diesel locomotive trucks at the San Bernardino, Cal., shops of the Santa Fe.

The first device is an arrangement for lifting trucks in and out of the lye vat. The tapered center portion goes into the truck center casting and acts as a guide to line the device up central. Uncoupling is accomplished automatically simply by lowering the crane, which trips a latch on the vertical sliding center stem.

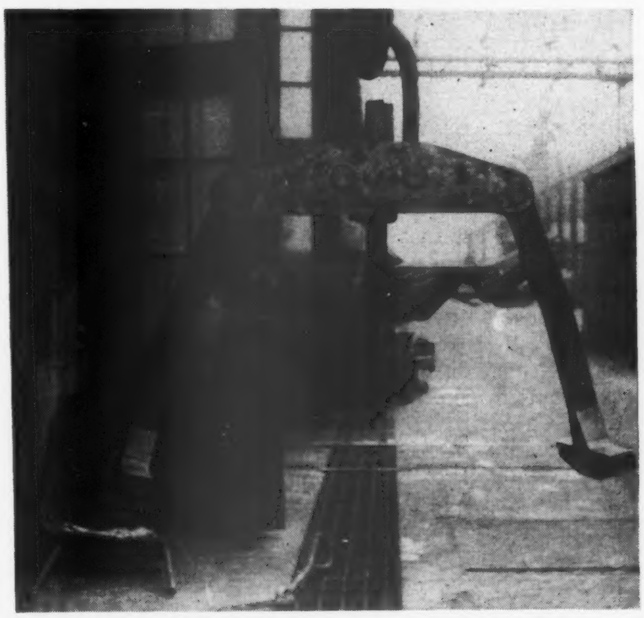
In immersing a truck in the lye solution, the crane and the carriage are both set to predetermined marks. When the truck is to be lifted out, the crane and the carriage are set in the same position. The lifting device is placed in open position and lowered onto the truck. When the taper portion hits the center casting, this trips the latch and the device closes in and takes hold underneath the traction motor supports.

After being thoroughly cleaned, the truck is placed on the repair stand and clamped in place with screw clamps at all jaws. Hydraulic jacks are then placed under the journal box spring pockets and raised to clear the pedestal jaw liners. Impact wrenches are used to loosen and tighten the liner bolts. Worn liners are turned or replaced. Broken coil springs are replaced at this time. The jacks have sufficient lift to lower the pocket so that the top of the spring is below the frame.

If the spring plank or the leaf springs require attention, a 50-ton air jack is located on a base under the center of the truck. On this base are hinged two yokes that swing over the lower traction motor supports, front and back. The jack then raises the spring plank, compressing leaf springs until the spring hangers are free to swing out and up to clear the springs where they are held with a special holding device. The jack is then lowered until the spring plank rests on four rollers that allow the plank with springs to be rolled out either side of the truck. Springs, whole or partial, can be lifted off with a wall crane.

If spring hanger bushings are to be replaced, a special hydraulic cylinder is used which will pull out the old bushings and press in new ones. To operate the hydraulic equipment, an air pump is used which can furnish air up to 2,000 lb. per sq. in.

Brake hanger bushings are removed and replaced with an air hammer. Repaired brake hangers are lifted in place with the wall crane.



Lifting device which automatically engages EMD truck while submerged in lye vat.

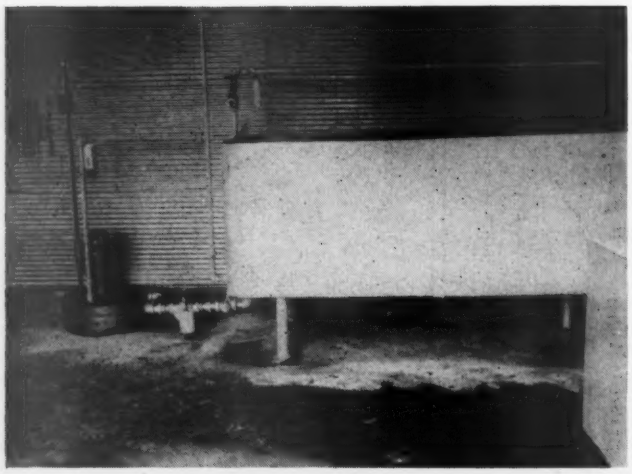
Journal boxes are placed on the journals and the wheels rolled to the wheeling track where the wheels go into position at correct spacing. The truck is lifted off the stand and set on the wheels, then being moved forward to receive the binders and traction motors.

Automatic Waste Oiler

The Toledo, Peoria & Western has solved the problem of keeping its stored journal box waste properly oiled without need for manual attention by the use of an ordinary household sump pump.

The sump pump, with typical float switch operation, makes an excellent arrangement for keeping the waste oiled. When the waste is put in the bin, it has the proper amount of oil. As this oil begins to settle out it drains into the sump, causing the float to rise and trip the starting switch, thereby putting the oil back in the waste.

The oil is distributed evenly over the waste through



Connecting the waste storage tank to a sump pump with a float switch makes completely automatic the continued reoiling of stored waste.

two lengths of $1\frac{3}{4}$-in. pipe in which is drilled $\frac{5}{32}$-in. holes 30 degrees from the vertical center line and 3 inches apart. The two spray pipes are 8 in. apart. The oil is delivered at the middle of this length of pipe through a tee by a third pipe; the delivery pipe is located half way between the two spray pipes. The three pipes are mounted one foot above the top of the tank.

The return line from the bottom of the tank to the pump is $1\frac{3}{4}$-in. pipe. A small cylindrical wire mesh filter is located half way between the tank and the sump. The tank itself is 30 in. by 84 in. by 28 in. deep, and has a steam coil for keeping the oil warm. The tank rests on four 2-in. tubes, and the pipes are supported by strap iron $\frac{1}{4}$ in. by $1\frac{1}{4}$ in.

A drain line of 1-in. pipe fitted with a valve is included in the delivery line for draining off excess oil. The spray pipes are closed at the ends by pipe caps to permit easy cleaning out.

Decisions of Arbitration Cases

Explosion Damage to Leased Car at an Industrial Plant

In an explosion and ensuing fire at Texas City, Tex., on April 16, 1947, tank car UTLX 96189, located in plant at Monsanto Chemical Company suffered practical destruction. The car had been moved into Texas City by the T&NO and physical placement on track in Monsanto plant was performed by Texas City Terminal Railway which does the switching for the several railroads at that point. As the car was under lease to Anchor Petroleum Company when destroyed, they authorized the owner, Union Tank Car Company, to bill them for its A.A.R. depreciated value, which amounted to $6,980.05 and settlement between them was negotiated on that basis. In August, 1948 the T&NO received Anchor Petroleum Company claim No. 01-07-501 in amount of $6,816.83 covering loss of this car. The difference between amount of this claim and the depreciated value represented a salvage credit allowed Anchor by Monsanto who had been authorized by Union Tank to dispose of wreckage. The credit amounted to 55 per cent of the net A.A.R. Salvage value. The T&NO contended that provisions of the A.A.R. Code of Rules Governing the Condition of, and Repairs to, Freight and Passenger Cars for the Interchange of Traffic do not make them responsible to Anchor for the loss of the car and the road therefore declined Anchor's claim.

In a decision rendered June 23, 1952, the Arbitration Committee ruled that "Under the provisions of Rule 113, Par. (1), the T&NO was responsible to the car owner for settlement for destruction of the car.—*Case 1838, Texas and New Orleans versus Anchor Petroleum Company.*

Responsibility for Flood Damage

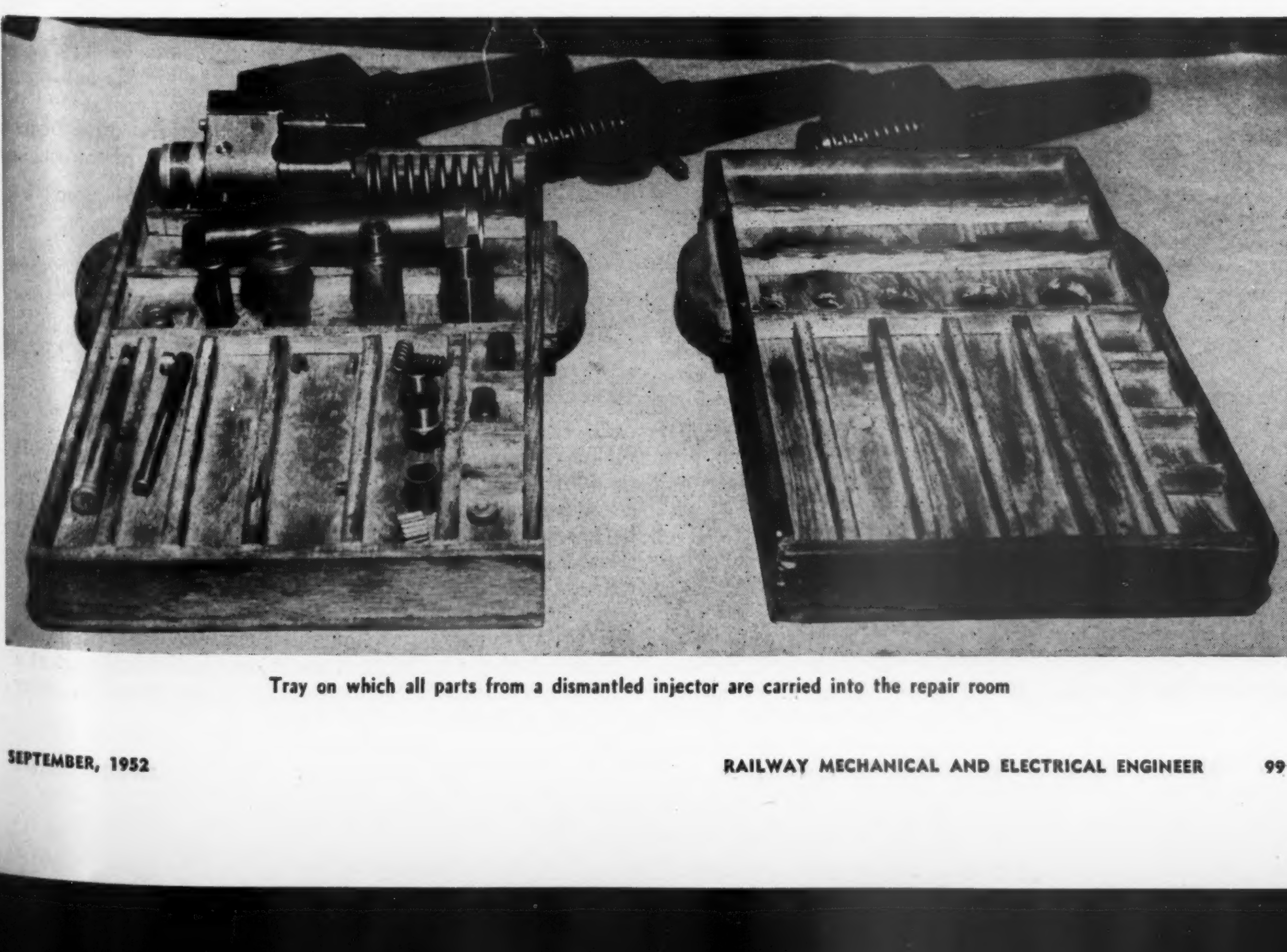
Thirty-five refrigerator cars owned by Merchants Despatch were damaged by flood waters at Kansas City, Kan., and Kansas City, Mo. between July 12 and July 16, 1951. The cars were at five different locations: (1) a dock track, part of which is owned by the Kansas City Southern and part by the Central Packing Company, with the company's portion maintained by the railroad for a fixed charge of 10 cents per foot per year in accordance with an Industry Track Agreement (ITA); (2) a KCS company track, also covered by an ITA and jointly owned and maintained on the same basis; (3) and (4) two tracks owned by KCS (called tracks 1 and 2) with use thereof covered by an ITA on which the packing company assumed no part of the maintenance; and (5) a KCS yard. The KCS contended that all of the flood-damaged cars were leased to Central Packing Company, within the meaning of Rule 113; that the tracks on which the flood-damaged cars were located at the time of submersion were either owned or were exclusively assigned to the Central Packing Company for use in its business; that the ITA covering dock track, KCS company track and tracks 1 and 2 constitute leases to the industry (within the meaning of Rule 113) of the portions thereof not owned by industry; that the cars were "home" on these tracks and also when in the yard by reasons of inability of the industry to receive them on the other assigned tracks. The KCS contends, therefore, that in accordance with the proper interpretation of Par. 1 of Rule 113, the railroad is not responsible for damages occurring to said cars leased by Central Packing Company, while so located. Merchants Despatch contended that the 35 cars were in the possession of the KCS; that the exception in Par. 1 of Rule 113 does not apply; and that the term lease used in Rule 113, Par. 1, is not intended to include a so-called lease of the kind, for the purpose and of the intent of the one in question under which Merchants Despatch furnished cars for the service of the Central Packing Company. Merchants Despatch therefore, contends that the KCS is responsible for the flood damage to said cars in accordance with Rule 32, Par. (10-1).

In a decision rendered June 23, 1952 the arbitration committee ruled that flood damages are handling line defects under Par. (1) of Section (10) of Rule 32. The 35 MERX cars were in the car account of the KCS at time damaged by flood. Tracks other than the dock track were not considered as leased to the Central Packing Company. Therefore, the KCS was held responsible for the flood damage 31 cars sustained while in its possession, as provided in Par. (1) of Section (10) of Rule 32. However, according to the exception in Par. (1) of Rule 113, the KCS was not considered responsible for the other 4 cars damaged while on the dock track as this track was owned by the lessee of cars.—*Case 1837, Merchants Despatch Transportation Corporation versus Kansas City Southern.*

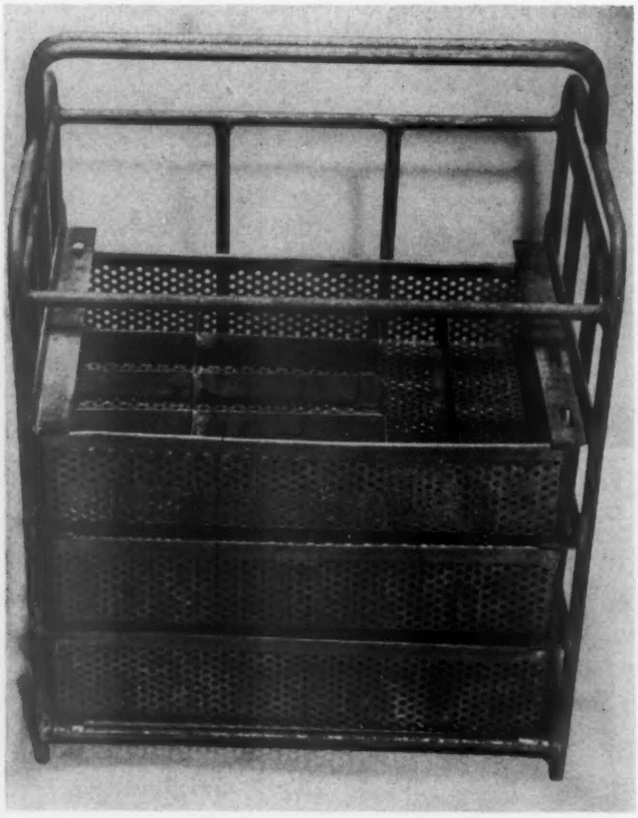
A corner of the pressurized room for reconditioning injector nozzles and governors. Completed nozzles are stored in metal containers on the open shelves at the left while parts are stored in the glassed-in cabinets on the right, and the workbench has a swinging tray

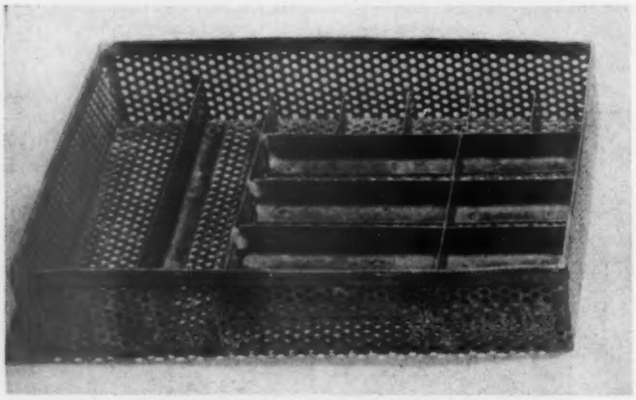
Injector Nozzle and Governor Test Room

The Pegram shops of the Southern at Atlanta, Ga., has a room about 16 ft. square and $7\frac{1}{2}$ ft. high devoted exclusively to repairing and testing diesel engine injector nozzles and governors. The room is completely enclosed to keep out dust, and the air within it is maintained at a pressure sightly above atmospheric by a blower driven by



Tray on which all parts from a dismantled injector are carried into the repair room





A group of the baskets in which injector parts are placed for cleaning

a 1/6-hp. electric motor. It is heated in cold weather by electric coils in the outlet stream of the blower, and is cooled in warm weather by circulating ice water through piping likewise located at the exhaust side of the blower.

Equipment in the room includes test racks for injector nozzles and governors, glassed-in storage cabinets along two of the walls, storage benches for completed governors, and a work bench for injector nozzles. The latter is fitted with the necessary drawers for small tools, with two air hoses for blowing parts dry, and with a container for mineral spirits. The container is normally located under the bench completely out of the way, but is mounted so that it can be swung free of the bench when in use. The bench also has a magnifying glass with fluorescent lighting for close visual inspection of small parts.

The reconditioning of injector nozzles begins outside the special room with dismantling, cleaning by dipping first in a commercial solvent (Turco) and then in mineral spirits, and delivery to the enclosed repair area in a specially built small wood tray that holds all parts of the disassembled injector. Any final cleaning required is given to the parts one at a time in the swinging tray with mineral spirits and small stiff brushes. All parts are inspected visually, using the illuminated magnifying glass where necessary, and replaced when defects are found. The check valve spring is always replaced. The only exception to this is where the injector is not dismantled but, tested only as in cases where a head is replaced for a leaking seal. Injector nozzles from such heads are pop-tested, and if found satisfactory, are not dismantled.

Lapping is done on two of three plates. One contains crystalline alumina as an abrasive. The surface is kept perfectly clean and is used for polishing. The third plate is a spare. Once each week the plates are reconditioned by grinding them together. When lapping is completed, the injector nozzle is assembled and put on the test rack.

After checking for proper spray on the rack, and to see that the nozzle pops between 700 and 1,200 p.s.i., the pressure in the line is allowed to drop to 1,000 p.s.i. An electric timer, graduated in seconds and tenths of a second, is started at 1,000-lb. pressure. To meet specifications for satisfactory secondhand nozzles, the pressure drop must not exceed 600 p.s.i. in 35 seconds. The glass container which catches the spray is removed and the nozzle tip and the rack seal checked for dripping and leaks. The completed nozzles are stored in metal containers on open shelves along one side of the room.

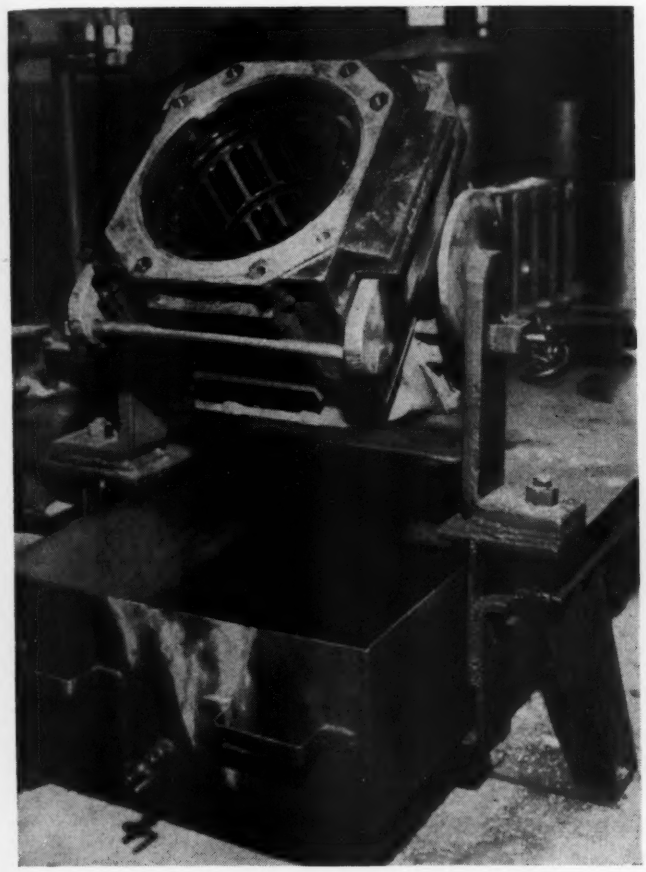
The bench on which the injector nozzles are tested has two shelves behind the doors on the bottom. These hold wrenches, tubing with fittings for application to the test rack, a pail for oil, and adaptors which make the bench suitable for testing injectors from any make of diesel engine. A bowl-shaped receptacle is stored under the bench to catch the oil from the nozzle that runs out when it is removed from the test rack. The right side of the bench has a Bendix-Scintilla fuel injection pump, the timer is in the center, and an E.M.D. pop tester is on the right. The top plate of this has been modified to permit, with the proper adaptor, the testing of several types of nozzles. Two tanks are located in the rear of the upper half of the test rack. One contains fuel oil and the second rust preventive for filling the completed injector.

Governors are dismantled inside the reconditiong room, but cleaed with mineral spirits outside the room. Both oil seals are renewed, and worn parts are replaced. After assembly the governor is tested for movement of the pilot piston on a Woodward test rack, which is equipped with an air motor and a means for applying a load to that motor. Completed governors are stored on a bench with the lower part fitting into 4-in. holes in the bench to hold the assembly securely.

Stand for Washing Roller Bearing Boxes

Diesel locomotive roller bearing boxes are cleaned quickly and thoroughly with the aid of a mounting stand developed at the C. & E. I. Oaklawn shops, Danville, Ill. The stand is built of heavy steel plate, and it positions and locks the box in any of several convenient positions. The cleaning solvent is contained in a sliding drawer directly underneath the stand.

The first step in the overall cleaning operation is the removal of the rollers and races, one individual part at a time to avoid reversing the position of any member. After



Holding stand and solvent drawer for cleaning diesel roller bearing boxes

these parts are cleaned in the solvent drawer, the box is cleaned in position on the stand and reassembled. The dirty solvent is drained when necessary through a pet cock near the bottom of the drawer.

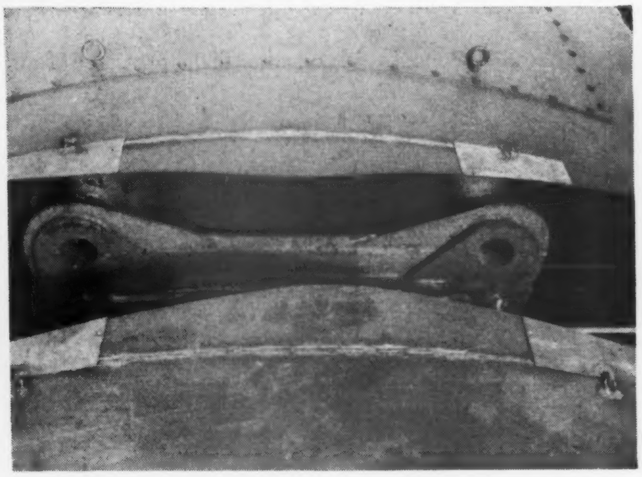
Lifting Diesel Units

The lifting arrangement illustrated is used to facilitate wheeling Santa Fe diesel locomotive units while in shop or lifting them in case of derailment.

The fabrication consists of laying out, burning and forming the component parts of the lifter. The different pieces are then assembled on a jig and tack welded together. After removing from the jig, the welding is completed. They are then sent to the machine shop for machining pin holes for the lifting or sling pins. While welding, the lifter is thoroughly peened, then being further stress relieved in a furnace.

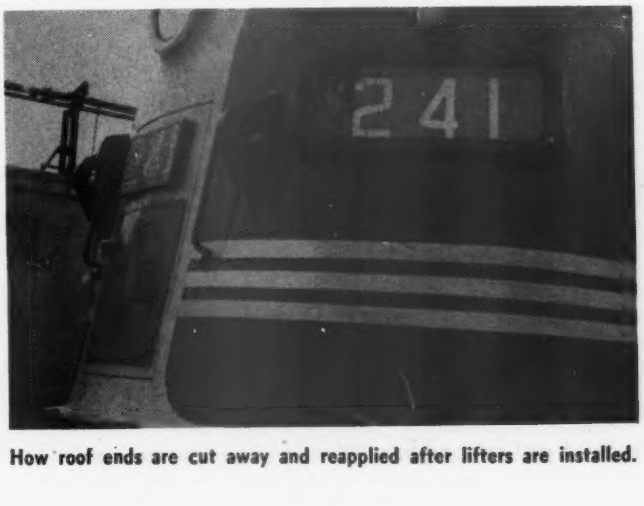
Lifters are applied to the square ends of diesel units at the top ends of crash posts. A section of the overhang of the roof is removed and saved for reapplying, as illustrated. A hole is cut in each side of the end sheets in line with where the pin hole in the lifter will come so that the lifting pin can be readily applied from inside the unit, the pin nut being applied from the outside. Hinged flaps cover these holes when not in use. The lifter is then placed in position and the plug and fillet welded to the crash posts. All welds are thoroughly peened during this welding operation. The section of roof overhang is then reapplied, leaving two hinged flaps, which are over the pin holes, so that the cables and clevices can be hooked up. With these flaps down in place, the unit has its original shape and the lifters are not noticeable.

In applying lifters to the nose ends of units, the covering of the hood frame is slotted and a lifter is welded close to the top of each of the two main crash posts in three pieces. One piece is butt welded to the post; the other two pieces lap the first piece, one on either side of the post, and are plug and fillet welded to the post and to the first piece, forming one solid lifting eye.



Application of two solid lifting eyes to the nose of a diesel locomotive unit on the Santa Fe.

How a lifter is applied to the square end of a diesel unit.

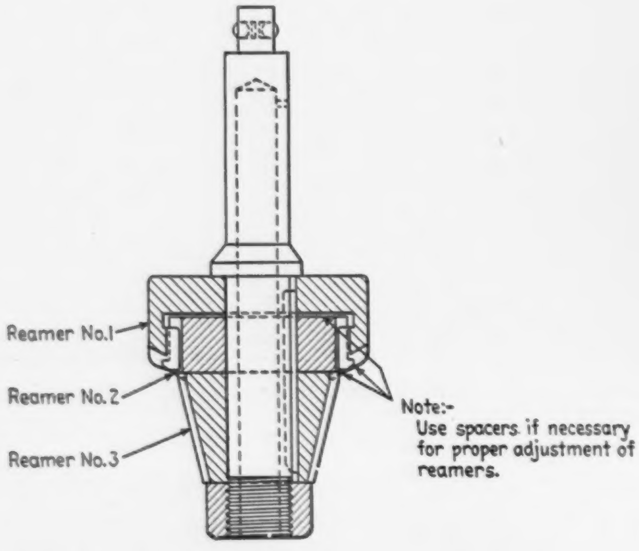


How roof ends are cut away and reapplied after lifters are installed.

Modified Drill Press Reconditions Heads

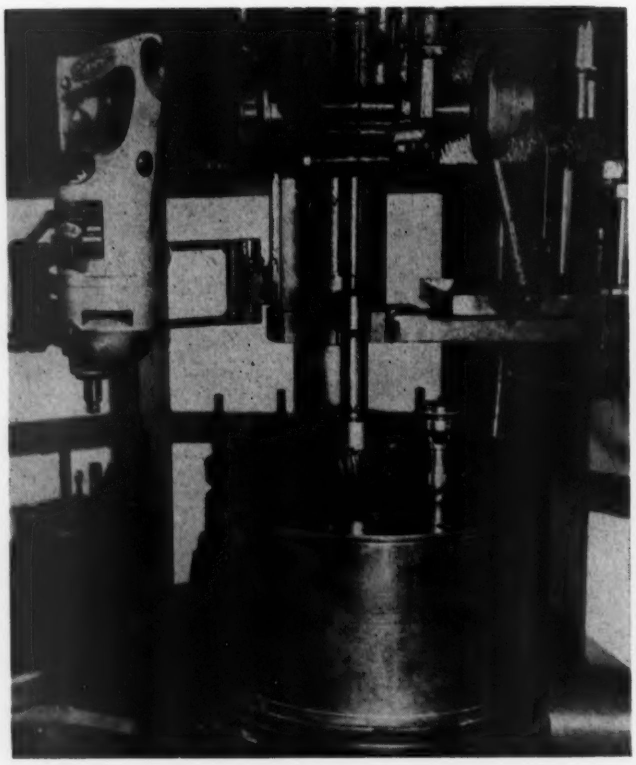
The Southern's shop at Chattanooga, Tenn., has modified a conventional Delta 36-in. drill press for reconditioning valve seats in diesel engine heads. The principal modifications comprise an arrangement for rapidly positioning the heads, a movable electric grinder, and a reamer which handles three operations with a single setup.

The head is positioned on the drill press by four



Details of the special reamer

Modified drill press for reconditioning Diesel cylinder heads



Cutting the seat clearance with three-cutting-head reamer

dowels. Slots cut in the machine base accommodate the positioning lugs. After the head has been secured in place a guide rod is inserted in the valve stem hole, and a special reamer is inserted in the chuck. This reamer has three cutting heads and performs three operation in one pass—cutting the seat clearance, cutting the seat, and reaming the exhaust port. Where the second operation, or cutting the seat, is not required, a second type of reamer is employed without the seat cutting section. In such cases the seat is merely ground.

The seats are finished with form guiding wheels, which run on the same guide used for the reamer. The grinding wheels are mounted on a Sioux No. 1703 heavy duty grinder which revolves at 10,000 r.p.m. The grinder is affixed to an arm which permits movement in any direction, and is spring mounted to this arm for vertical movements.

The head stand is self-locking in any one of four positions, putting the valve guide directly under the drill press spindle. Release is by foot lever.

Applies-Removes Baldwin Liners

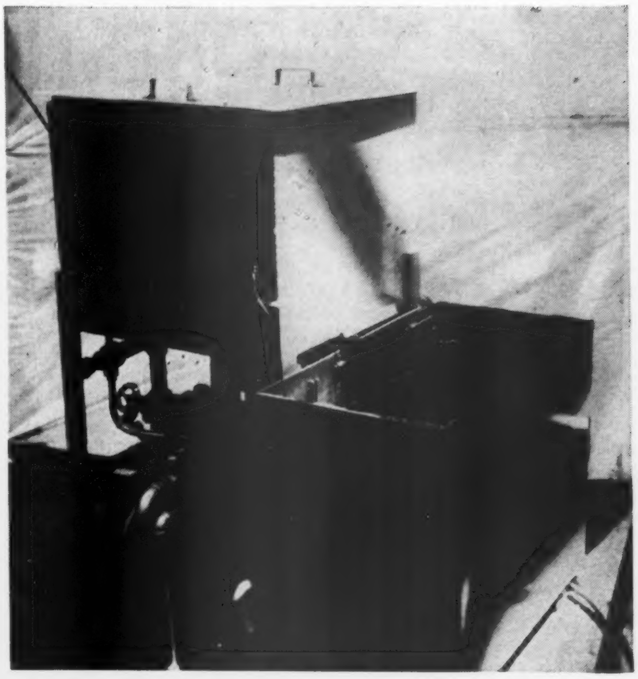
Liners on Baldwin locomotive engines can be easily applied or removed with an arrangement built by the Santa Fe at Argentine, Kan. The device consists of three parts, two plates and a long bar, and is used with a hollow-shaft hydraulic jack for either operation.

Referring to the illustration, the plate on the left fits on top of the cylinder while the one on the right fits under the liner. The long bar goes through the holes in both plates. The hollow-shaft jack slips over the top of

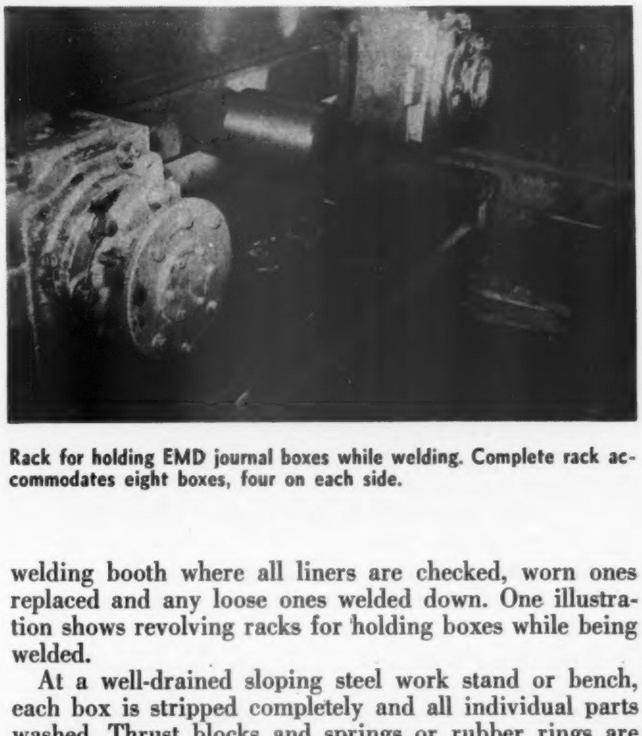
Arrangement used with a hollow-shaft hydraulic jack for removing or applying Baldwin liners

the bar, with the rod fitting through the shaft, and a key slips into a slot near the bottom of the bar directly underneath the bottom plate. The top nut of the bar is put on and turned until it contacts the jack shaft.

With the jack shaft pushing against the top nut of the bar the liner can be lifted the first two inches, after which it is free. During this initial 2-in. lift to free the liner from its snug fit, the liner is guided by the inner ring of the top plate. This ring fits inside the liner, and is 2 in. deep to permit the liner to be lifted this amount before contacting the bottom edge of the top plate. The area of the plate outside of the ring is cut out to clear the studs.



Journal-box washing machine. Motor-driven table revolves each box while being cleaned with inner and outer sprays.



Rack for holding EMD journal boxes while welding. Complete rack accommodates eight boxes, four on each side.

Reconditioning Hyatt Roller-Bearing Boxes

In reconditioning Hyatt roller-bearing boxes at one large system railway shop, the first operation after draining the oil is to slide each box off the end of the axle and take it to the journal box washing machine. Here the box is revolved at a speed of 7 r.p.m. while No. 24 Oakite is sprayed at 35-lb. pressure inside and outside. Then, with the box still revolving, a jet of water and steam, then all steam, then air, and last a spray of Oakite special protective oil are shot on the box, the oil going to the inside only. A special device is used to lift journal boxes in and out of the washing machine.

The box is then taken from the washing machine to the welding booth where all liners are checked, worn ones replaced and any loose ones welded down. One illustration shows revolving racks for holding boxes while being welded.

At a well-drained sloping steel work stand or bench, each box is stripped completely and all individual parts washed. Thrust blocks and springs or rubber rings are checked, also spacer rings, any necessary repairs being made. All rollers and the outer sleeve are inspected for defects and any worn or defective parts replaced. The roller bearings are re-assembled and all parts put in place. A new inner race is applied inside the bearings which are tested to see that they turn freely in the box. This is a check against warpage while welding. The cap is applied and set screws wired in place.

The open end of the journal box is covered with a special piece of round sheet metal with four spring clips to hold it in place and keep out dirt until the box is applied.

QUESTIONS AND ANSWERS

Diesel-Electric Locomotives*

Cooling Water System—*Continued*

542-Q.—What provision is made to take care of extremely high temperatures?

A.—A thermal sensitive element is installed in the left bank water outlet manifold between the engine and radiators.

543-Q.—How does the element function?

A.—If the water temperature at this point reaches 185 deg., a high temperature switch located below the fan control, will operate.

544-Q.—What then happens?

A.—A hot engine indicating light will light, an alarm will sound in the cab and the engine in the unit affected will return to idle.

545-Q.—Is there an adjustment to the high temperature switch?

A.—One adjustment can be made, range cut-in temperature only.

546-Q.—How is this adjustment made?

A.—Raised by turning the top adjusting screw down and lowered by backing it out.

547-Q.—Should any attempt be made to adjust the differential temperature?

A.—No. It is factory adjusted and should not be tampered with.

548-Q.—What types of temperature control are in service?

A.—There are two types: Minneapolis-Honeywell and General Electric.

549-Q.—From where is the air for operation of engine water temperature control received?

A.—From the main reservoir through a 70 lb. reducing valve, cut-out valve and filter.

550-Q.—Is this pressure used for the operation of water temperature control?

A.—No, the filtered air is then reduced from 70 lb. to 17 lb. by a reducing valve.

551-Q.—Where does this reduced air then flow?

A.—It passes directly to the engine temperature thermostat.

552-Q.—What is done to protect this low pressure line?

A.—A relief valve, set at 19 psi. is mounted in the low pressure line connecting the reducing valve to the thermostat, as a protective measure.

553-Q.—What is the function of the thermostat?

A.—The thermostat acts as a variable pressure reducing valve, interpreting engine water temperature in terms of air pressure.

554-Q.—To where does the air flow from the thermostat?

A.—The air pressure leaving the thermostat, known as pilot or branch line pressure, is piped directly to two pneumatic electric relays, and two shutter Grad-U-Motors.

* This series of questions and answers relate specifically to the co-G.E. Diesel electric locomotives. The figure numbers and references, by number, to diagrams, etc., relate to the current edition of the Alco-G.E. operating and maintenance manual.

555-Q.—How do the relays function?

A.—To control the fan speed.

556-Q.—How do the Grad-U-Motors function?

A.—To control shutter positioning.

557-Q.—How does the air pressure act in relation to the temperature in the thermostat?

A.—The thermostat is reverse acting. When the temperature rises the pressure in the pilot line falls.

558-Q.—What does each pneumatic relay of pressure switch represent?

A.—Each switch represents a particular fan speed.

559-Q.—What are these settings?

A.—P-1 set at 11 lb. for medium fan speed and P-2 set at two lb. for full fan speed.

560-Q.—How are these switches connected electrically?

A.—Each switch is connected electrically to one of two relays. Relay R-1 is associated with the 11-lb. switch and R-2 with the 2-lb. switch.

561-Q.—What type shutters are used with this system of control?

A.—The shutters are the modulating type, controlling in any position from full close to full open position.

562-Q.—What determines the positions?

A.—The positions are determined by the engine water inlet temperature.

563-Q.—At the point that engine temperature has risen to 145 deg. F, how is the pressure in the pilot line affected?

A.—At this time the pressure in the pilot line drops to 13 psi.

564-Q.—What action then takes place?

A.—When the pilot line pressure drops to 13 psi. the Grad-U Motors start to function, causing the shutters to partially open.

565-Q.—As the engine temperature continues to rise with a corresponding drop in air pressure, what takes place at 11 psi?

A.—At 11 psi. relay R-1, which is associated with the 11 pound switch will energize the Eddy Current Clutch field through a 10 ohm resistance.

566-Q.—What action then takes place?

A.—The fan will start at medium speed.

567-Q.—With the rise in temperature and drop in air pressure how are the shutters affected?

A.—If the temperature continues to rise a further drop in pilot line pressure will take place, causing the shutters to open wider until 3 psi. pilot line pressure is reached, at which time the shutters will be fully open.

568-Q.—What takes place to produce full fan speed?

A.—When the water temperature reaches 155 deg. F. the pilot line pressure will have reached 2 psi. causing the 2-lb. switch to drop out, which in turn brings in the second relay, thus lowering the resistance in the Eddy Current Clutch field resulting in full fan speed.

569-Q.—What is the operation as the water temperature drops?

A.—The series of events will take place in reverse order.

570-Q.—How is the control set up for automatic operation?

A.—For automatic operation the radiator fan control

switch should be in *Automatic* position on the control panel (Fig. 3).

571-Q.—What additional preparation is required?

A.—Both shutter motor drive rod yokes should be connected to the shutter operating links with link locking pins removed and placed in receptacle on the inside of the hinged cover.

572-Q.—What can be done if either the fan or shutters or both are not working?

A.—The equipment can be operated manually.

573-Q.—What must be done to prepare the equipment for manual operation?

A.—First, close the cut-out cocks to both air filters (Fig. 1) and bleed the system by opening the drain valve in the base of each filter.

574-Q.—What additional preparation must be made in order to operate the equipment manually?

A.—Referring to Fig. 4, the shutter linkage must be altered.

575-Q.—How is this change made?

A.—Remove one inch pipe from receptacle and apply to stub end of shutter operating link. Lift up on pipe and remove chained pin. Position shutter operating link with locking pin in one of the three holes provided for full open, mid-position or full closed shutter.

576-Q.—How is the fan speed provided for?

A.—Move the fan speed control switch to "off," "medium" or "full" fan speed so as to maintain 140 to 160 deg. F. engine water temperature.

Maintenance—Reducing Valve, Filter and Relief Valve

577-Q.—What pressure must the reducing valve be set for?

A.—17 psi.

578-Q.—What would be the result of a lower setting than 17 psi?

A.—A lower setting will cause the fan to operate continuously.

579-Q.—What attention should be given the filter?

A.—Blow down weekly, or more often if necessary, by opening the drain valve. Remove strainer assembly and clean monthly.

580-Q.—At what pressure is the relief valve set?

A.—19 psi.

581-Q.—How is the pressure adjusted?

A.—Remove cap, loosen lock nut and turn adjusting screw clockwise to increase pressure and counter clockwise to decrease pressure setting.

582-Q.—How much blow down should there be?

A.—One to two lb.

583-Q.—How is the adjustment made for the blow down?

A.—To adjust for one pound blow down, remove the lock screw from the side of the valve. Insert a small tool through the screw hole to engage the grooved edge of the regulating ring. Turn the ring clockwise to decrease blow-down, and counter clockwise to increase blow-down. When setting is completed replace the screw and test.

Engine Temperature Thermostat—Operation

584-Q.—Referring to Fig. 7, how is the valve unit (11) designed?

A.—The valve unit is so designed that the branch line pressure is regulated by the force exerted by the temperature sensitive element (18).

585-Q.—How is this force utilized?

A.—The force generated by element *18* is transmitted through the lever system to the valve unit diaphragm *10*.

586-Q.—What opposes the force exerted against the diaphragm?

A.—The force exerted by the air pressure in chamber 7.

587-Q.—Where does this air pressure come from?

A.—Chamber 7 is open to and has the same pressure as the branch line *9*.

588-Q.—In the event that the two forces acting on the diaphragm are equal, what takes place?

A.—When the two forces are equal, the supply port (5) and exhaust (6) are held closed by the action of the valve lever (8) and the spring.

589-Q.—What takes place when the external force on the diaphragm increases?

A.—An increase in the external force exerted by the lever system unbalances the lever (8).

590-Q.—With the lever thus unbalanced, what takes place?

A.—The lever then pivots on the exhaust port ball and opens supply port (5).

591-Q.—With the supply port open what takes place?

A.—Air feeds into the valve chamber (7) and the branch line (9) until the valve lever rebalances, closing the supply port.

592-Q.—What happens if there is a decrease in the external force exerted on the diaphragm?

A.—A decrease in the external force unbalances the valve lever in the opposite direction.

593-Q.—With the valve lever thus unbalanced, what is the action?

A.—The valve lever then pivots on the supply port ball and exhaust port (6) is opened.

594-Q.—Does this action result in a balance in the forces on the valve unit stem?

A.—Yes. Air exhausts from the valve and branch until the forces on the valve stem are again in the balance. Thus air is exhausted only when the branch pressure is being reduced.

595-Q.—What factor determines the external force on the diaphragm?

A.—The external force on the diaphragm is proportional to the difference between the forces exerted on the main lever (3) by the main spring (2) and the auxiliary spring (14).

596-Q.—With the main lever pivoted (4), what determines the force on the valve unit stem?

A.—The force on the valve unit stem is proportional to the force of the auxiliary spring less the opposing force of the main spring.

597-Q.—What determines the forces exerted by the auxiliary and main springs?

A.—The force exerted by the auxiliary spring is fixed at the factory. The force exerted by the main spring however, is determined by the auxiliary lever (1) which in turn is acted on by the element stem (17).

598-Q.—What governs the action of the element stem?

A.—The element stem responds to the extension or compression of the bellows resulting from the expansion or contraction of the liquid in the element.

599-Q.—What causes the expansion or contraction of the liquid?

A.—This is caused by temperature changes.

600-Q.—Give an example of the action when there is an increase in temperature at the thermal element?

A.—The liquid fill expands, compressing the bellows and moving the element stem (17). The stem moves

auxiliary lever (1) pivoted at (15), to compress main spring (2).

601-Q.—What happens when the main spring is compressed?

A.—With the main spring compressed the force exerted on the valve unit stem is decreased.

602-Q.—How does this affect the branch line pressure?

A.—The branch line pressure is decreased in proportion.

603-Q.—What action takes place when there is a decrease in temperature?

A.—The liquid contracts, the bellows expand and the element stem moves away from the auxiliary lever.

604-Q.—What action then follows?

A.—The force exerted by the main spring on the main lever decreases and the branch line pressure increases proportionately.

Schedule 24 RL

Air Brakes

1380-Q.—What is the action if control pipe 16 air in chamber B is reduced?

A.—When control pipe pressure on the face of the piston is reduced, brake cylinder pressure on the back of the piston (chamber A) causes the piston to move downward.

1381-Q.—How does the downward movement of the piston affect the lever 19?

A.—As the lever is fulcrumed at its right end, the left end of the lever now moves downward, allowing exhaust valve *27* to open.

1382-Q.—Is the exhaust fully open with exhaust valve open?

A.—No. Brake cylinder pressure then flows past exhaust valve, balancing the pressure on exhaust piston *29*, permitting it to open easily. Brake cylinder air in chamber *A* then flows to exhaust (EX.).

1383-Q.—What takes place in the event that control pressure is only partially released?

A.—Brake cylinder pressure will continue to flow to the exhaust until the pressure on the back of piston is lower than that on the face at which time the piston moves upward seating the exhaust valve and the exhaust piston.

1384-Q.—What is the position of the relay valve at this time?

A.—The relay valve is now in *Lap* position.

OPERATION OF THE F-6-F-8 AND F-1 RELAY VALVES

1385-Q.—What pressure flows to the F-6 relay valve at the time the system is being charged?

A.—Main reservoir pressure.

1386-Q.—Describe the flow of main reservoir air to the relay valve.

A.—Air from the main reservoir pipe flows through choke *15* to the spring chamber back of application piston valve *30* and to the outer face of the piston, the air pressures thus being balanced.

1387-Q.—If the pressures are balanced, what force serves to hold the piston valve and pilot valve seated?

A.—With the air pressures thus balanced, spring force holds them seated.

1388-Q.—How does passage 16 in the relay valve connect to atmosphere?

A.—Through pipe *16* to passage *16* in the control valve which is connected to exhaust *10* with the control valve in release position.

1389-Q.—How are the diaphragm chambers in the relay valve connected to passage 16 and consequently the exhaust?

A.—Diaphragm chambers *A* and *K* are connected through passages *16a*, *17a*, and *17* to passage *16*. Chambers *N* and *P* are connected through passages *18a*, *19a* and *19*, past supply valve *92* to passages *17* and *16*.

1390-Q.—With the diaphragm chambers thus connected to the exhaust, what takes place?

A.—Release spring *42* in the relay portion holds piston *36* and the diaphragm stack in release position, where lever *43* is moved to release position, opening exhaust piston *25* and its valve *23*.

1391-Q.—With an application of brakes how does air from control pipe 16 flow to diaphragm chambers A and K?

A.—Air from the control pipe flows through strainer *17* and passage *16a* to diaphragm chamber *A*, and through passages *16*, *17* and *17a* to diaphragm chamber *K*.

1392-Q.—Does control pipe air also flow to the other two chambers?

A.—Yes. Air also flows through passage *17*, past supply valve *92* to the face of diaphragm *85*, thence through passages *19* and *18* to diaphragm chambers *P* and *N*.

1393-Q.—What takes place when approximately 7-lb. pressure is obtained in chamber C in the inshot valve?

A.—Inshot diaphragm is deflected, compressing spring *88* and moving piston *84* sufficiently to permit spring *94a* to seat the supply valve *92*.

1394-Q.—What results from this operation?

A.—When the supply valve closes, further flow of air to diaphragm *N* and *P* is cut off.

1395-Q.—With the initial 7-lb. inshot pressure obtained in all of the diaphragm chambers, what takes place?

A.—This pressure is directly effective in chamber *P* where it acts on diaphragm *38*, overcomes the resistance of spring *42* and deflects the diaphragm, moving the self lapping portion to application position.

1396-Q.—What further movement takes place?

A.—The exhaust valve and its piston are seated by the lever *43* and the pilot application valve and its piston are opened, permitting main reservoir pressure to flow to the brake cylinders.

1397-Q.—What braking effect does this operation provide for?

A.—This provides a low brake cylinder pressure sufficient to take up brake rigging slack and apply the brake shoes to the wheels.

1398-Q.—Is the 7-lb. inshot pressure in chamber P retained after the inshot supply valve closes?

A.—Yes. In this manner this inshot pressure is maintained directly on diaphragm *38*.

1399-Q.—Where does further build up from control pipe 16 take place?

A.—Further build up can take place only through passages *16a* and *17a* to chambers *K* and *A*.

The Spectroscope in Railroad Service

Opinions vary widely concerning the value of spectroscopic analysis of diesel locomotive lubricating oil. A few feel it is just a fancy gadget which might perhaps be used by astronomers for weighing the stars, but not a thing which has any place in the railroad shop. Many feel it can contribute importantly to good locomotive operation and some believe it should be used constantly to insure long life of parts and to anticipate potential engine failures. A few expressions of personal opinion may serve to illustrate.

One railroad used a spectroscope to determine ingredients of lubricating oil put into an engine crankcase before leaving a terminal. The oil was shown to contain nothing which might cause trouble or that would indicate an unsatisfactory condition in the engine. The locomotive hauled a train to another terminal and returned with a second train to the first terminal. A second spectroscopic test of the oil showed that it contained silver. This could have meant bearing trouble, but further investigation showed that lubricating oil had been added at the second terminal, and that that oil contained some silver. The circumstance illustrated the importance of intelligent diagnosis, and led the railroad to conclude that it must control its use of oil more closely if the value of the spectroscope is to be realized.

Some operators say quantitative spectroscopic oil analysis is too slow, that a railroad cannot afford to keep a locomotive standing around while an oil sample is run through the laboratory. In reply, proponents of the spectroscope say that it is not necessary to hold a locomotive, that any necessary information can be transmitted, and that quantitative tests costing five to ten dollars need only be made after qualitative tests indicate that they are required. The qualitative test referred to consists of making three successive shots of a given sample, and noting whether the suspected harmful ingredient disappears in the second or third test. If it does, the quantity of the ingredient is considered to be so small as to be harmless. An operator can make at least 40 such tests in a day.

Some of the more experienced operators of the spectroscope go on to show how its use is not limited to lubricating oil analysis. They show, as examples, how a certain carbon paper containing an injurious ingredient was causing the sickness of a stenographer, how harmful elements were discovered in food and water, and how the work of the railroad chemical laboratory is greatly reduced when it becomes necessary to determine the make-up of a metal or other substance.

One seasoned locomotive shop superintendent, when asked for an opinion, replied, "There is no substitute for good maintenance." He went on to say that certain things must be done and that most of them need not wait on word from the laboratory. Often, too, he said, it is cheaper to do the work than to make a spectroscopic analysis.

A contemporary shop operator offered the opinion that spectroscopic lubricating oil analysis means very little because of the uncertainties involved in sampling the oil. "How," he asked, "can one get a sample containing everything in the oil by taking a thimbleful out of 100 gallons?" He added that the laboratory could serve, but could not run the shop.

Another said, "You can see water in the oil and you can smell fuel oil, and nothing complicated is needed to indicate these two most common troubles with lubricating oil."

In the last analysis, the diehards will concede that the spectroscope can perform valuable functions, and the most ardent proponents, when pressed, will admit that results depend importantly on getting characteristic samples, and on having laboratory technicians with enough diesel operating experience to know just what a certain spectrographic record means.

Are Second-Hand Wheels Worth Storing?

When a pair of wheels are pressed off an axle because of a badly cut journal or some other defect serious enough to condemn the axle to the scrap heap, a decision must be made as to which of three courses should be followed for disposition of the wheels. Should all such OK second-hand wheels be scrapped; should they be stored for use on company-owned equipment only; or should they be placed in storage for general usage on either system or foreign cars?

The latter two courses are tempting because of natural reluctance to throw away usable wheel mileage for which the railroad has paid out hard-earned money. Nevertheless there remains a very real and practical question as to whether the cost and nuisance of saving the wheels can be justified as a general policy.

Before the wheels can be remounted on any but home cars they must be rebored, and thus become limited for reapplication to axles with relatively large wheel seats. A substantial amount of time can be lost finding an axle and a pair of wheels that will match up for proper mounting pressure.

And the problem may not end here. When two wheels are found with the proper bore diameter for mounting,

half the time the tape sizes vary too much, and the search must begin again to find a third wheel that will match up with both the bore and the tape of one of the first two wheels.

Going through the above procedure can be a headache for any wheel shop foreman when the wheels are to be mounted on new axles. Matching up both for fit and bore can be an intolerable waste of time when using a second-hand axle on which the seat has been turned.

With the high cost of labor it would seem therefore that the practice of saving OK second-hand wheels is open to serious question, particularly at a large wheel shop laid out for high production where the operational sequence would be interrupted. Would it not be more economical in the long run either to throw away the used wheels, or to restrict their application to system cars for which service they would not have to be rebored, and for which the problem of matching up both bore and tape size would be comparatively simple?

Private Line Car Repairs

The comment is sometimes heard, perhaps less frequently now than formerly, that some private car owners either maintain no shops or repair tracks of their own, have an insufficient number of these shops, or do not keep them well equipped and fully manned. The result is that they fail to perform a reasonable share of repair work on their cars which accordingly has to be done by someone else. Since all car owners as well as railroads are in the rail transportation business together and hence interested in getting freight-car loads from originating point to destination without delays, it behooves all and sundry to pull together in the most effective joint car maintenance program which can be developed.

Illustrative of what can be done, one car owner reports that refrigerator and tank cars received at his home shop for repairs are given a preliminary inspection; complete historical data recorded; delivery line defects checked and, if not carded, provision made for joint inspection; car classified for light, medium, or heavy repairs; repairs written up on shop record of repair form; cost of material and labor estimated and, if approved by management in view of the age, general condition and need for the car, repairs are authorized; write-up serves as requisition for material; steel men make whatever repairs are necessary to trucks, underframes, couplers and draft gears; all steel items are checked for good workmanship; particular attention is given to truck springs and snubbers for ride control; A.A.R. Rule 66 is strictly adhered to in reconditioning car journals and boxes.

Carpenters are assigned to repair the car exterior and interior, floor racks, end and side wall racks, ceiling, bunkers, roof, hatch covers and safety appliances. Air brake application, repairs and testing are performed in accordance with A.A.R. Rule 60 by qualified air brake repair men. All operations are closely supervised by repair foremen in the progressive stages of repairs.

Afterwards, the car is again inspected to be sure all work is in accordance with A.A.R. regulations and recommended shop practices. The car is painted; set on the forwarding track; given a final check up and routing instructions secured for movement to a customer's plant, for loading.

It is recognized that the procedure just described covers refrigerator cars, only, but it may be reasonably assumed that similar care is taken in repairing and reconditioning private cars of all other types when the car owner is equally determined to do a thorough job and turn out cars which will give many thousands of miles of revenue service without frequent intermediate visits to railroad rip tracks and car repair shops.

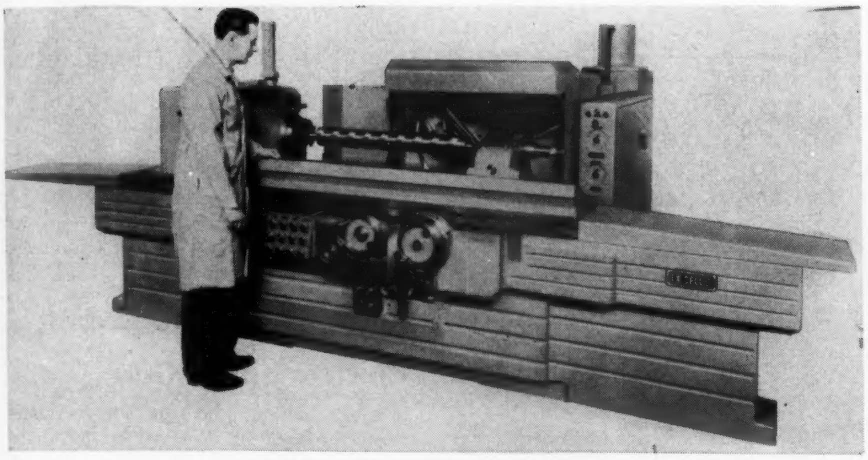
NEW BOOKS

Elementary Heat Power. *Second Edition. By Professors Harry L. Solberg, Orville C. Cromer, and Albert R. Spalding, Purdue University. Published by John Wiley & Sons, New York. 624 pages, 5½ in. by 8½ in., cloth bound. Price, $6.50.*

Elementary Heat Power, prepared as a text to be used in a first course in engineering thermodynamics, or in a terminal course for non-mechanical engineering students, is intended also for those with several years' experience in the various fields of heat power who wish to arrive at a better understanding of the principles behind the equipment they operate. The revisions in this edition keep in mind the original objectives of the book which were to develop an understanding of the functions, principles of construction, and actual performance of heat-power machinery; to provide an adequate and balanced terminal course for students who do not study engineering thermodynamics, and to provide a background for testing heat-power equipment in the laboratory. Fuels and Combustion, Internal-Combustion Engines, Fuel-Burning Equipment, Steam Generation, Steam Turbines, and the Gas-Turbine Power Plant are among the thirteen chapter headings.

Illustrated Petroleum Dictionary and Products Manual. *Published by Petroleum Educational Institute, 9020 Melrose avenue, Los Angeles 46. 502 pages, 5½ in. by 8½ in. Price, $8.*

This book, prepared on an elementary level, is especially designed for those who do not possess a technical background in petroleum. Its purpose is to provide products information for sellers, buyers, and consumers of petroleum products, and to make available a dictionary of terms commonly used in the petroleum and other industries in connection with petroleum, its products and the equipment utilizing these products. In the preparation of the book local authorities were consulted in an effort to clarify some of the unclassified terms now in general use.

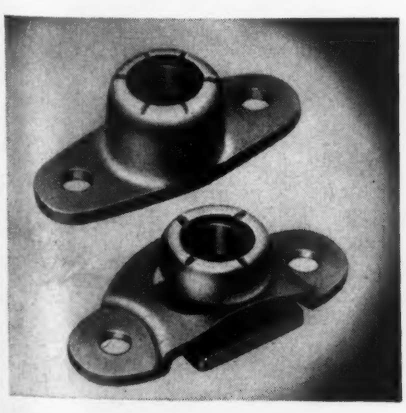


Large Capacity Thread Grinder

A large-capacity machine, the Style 36 Precision Thread Grinder, has been designed for grinding threads, worms and other forms. It is claimed to have the flexibility required for toolroom work, speed production work and maintenance operations. It will grind single or multiple threads, left or right hand, in any pitch from 1 to 28 threads per in. Single- or multiple-rib grinding wheels can be used.

Several types of diamond dressers may be used on the grinder, made by the Ex-Cell-O Corporation, Detroit 32, the choice being determined primarily by the type of thread or form to be ground.

Automatic functions of the device include feed to finish size, wheel dressing, work size compensation for dressing, resumption of grinding cycle after dressing, backlash compensation, control of coolant flow, lubrication, and retracting the wheel at the end of the grinding cycle.



Floating Anchor Nut

Quick self-alignment and simplified assembly of component parts is now possible through the introduction of the model A-41 floating anchor nut, according to its manufacturer, the Elastic Stop Nut Corporation of America, Union, N. J. Weight savings of 1.3 lb. per thousand pieces are claimed over earlier anchor nuts of this type.

Redesign of its old type floating anchor nut permitted the manufacturer to give the new unit smaller over-all dimensions than before. As a result, it is the same size as the firm's standard non-floating anchor nut and complies with all AN 366 (Army-Navy) dimensional and performance requirements.

A special feature of the part is the offset shoulder on the anchor lug which assures full floating action of the nut by preventing interference between it and the two rivets holding the lug to a part or assembly.

The device contains a fiber or nylon locking collar which bolts the nut on the bolt with a positive grip. This principle is utilized to prevent nuts from working loose under all conditions of vibration and impact loading.

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Dual-Purpose Preservative Oil

Extensive research has resulted in the development of a dual-purpose lubricant by The Texas Company, Port Neches, Texas. Produced in two grades, Texaco Preservative Oil 10, and 30, functions both as a lubricant and a preservative for the internal combustion engine which is temporarily taken out of service for storage or shipment. It eliminates the need for handling two products successively.

The product combines special additives developed to ensure maximum preservation of internal engine surfaces with motor oil additives of the type used in heavy duty lubricants. These preservative oils incorporate characteristics which in some instances exceed by five-fold the requirements of military specifications.

In addition to its application in "out-of-service" engines, the lubricant-preservative has proved useful in other internal combustion engines in intermittent service. When functioning as a lubricant, it need not be changed until the engine has reached the normal drain-and-refill point. It is compatible with qualified heavy-duty motor oils.

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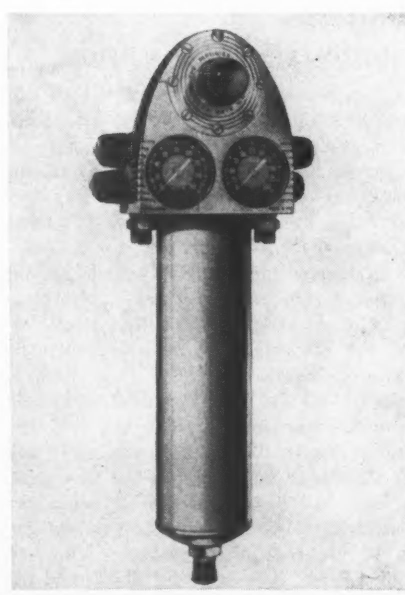


Two-Stage Air Transformer

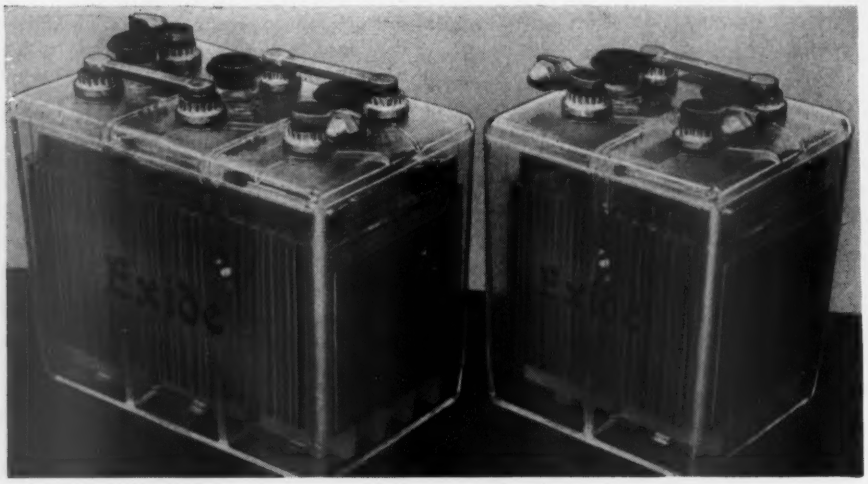
A transformer has been marketed which has a built-in two-stage regulating principle. This provides for easy adjustment of pressures, requiring only finger tip control of the adjusting knob. The knob actuates a small pilot regulator which in turn operates the diaphragm of the large regulator, giving ease of operation.

Oil and moisture, present in all compressed air lines, is eliminated by the model HLD transformer, introduced by the DeVilbiss Company, Toledo, Ohio, which traps the liquids and delivers clean air to the outlets. In tests, 97 per cent of entrained water was removed from 100 cu.

ft. per min. of air at 100 lb. pressure.

The unit has two regulated air outlets and two unregulated. It has a capacity of 100 cu. ft. per min. Oil and moisture captured in the condenser tube is drained by a pull-push drain knob. Pulling the knob down closes the drain, pushing up opens it.

Corrosion resisting metals are used in all parts of the condenser chamber which come directly in contact with compressed air. The head of the transformer housing the regulator, two pressure gauges and valves is a zinc die casting, as is the regulator cap.



Batteries for Stationary Application

A new series of storage batteries of two-cell and three-cell construction for stationary applications offering advantages in space and weight saving, maintenance and improved dependability, have been made available by the Electric Storage Battery Company, Philadelphia, Pa.

Designated as Exide Type PLX, the batteries are in transparent polystyrene plastic cases designed to show the level of the electrolyte, and the approximate state of charge.

Markings on the transparent case indicate the recommended high and low electrolyte levels. Built into each outer cell is a chamber in which a red, a white, and a blue ball float in electrolyte when the battery is fully charged. When the battery is 10 per cent discharged the blue ball sinks. When it is one-third discharged the white ball sinks, and when two-thirds discharged the red ball goes down.

An improved safety factor is achieved by an automatic venting device of clear polystyrene built into each cell to prevent excessive gas accumulation.

Applications for which the new Exide PLX Series is recommended include electric switchgear, communications, emergency lighting and power, laboratories, railway signaling equipment, rural electrification, and alarm systems.

Exide's choice of clear polystyrene is the result of years of experience with this versatile material. The company says that in addition to its proven stability and resistance to acids, it virtually eliminates the breakage which hitherto has been a problem in the transportation and handling of storage batteries in glass jars.

The two-cell PLX batteries have a 50-amp.-hr. capacity at the eight-hour rate, while the three-cell units have a 100-amp.-hr. capacity at the same rate. They may be used in combinations to supply any desired range of voltages.

In construction, the clear plastic cover is firmly cemented to the case. Positive plates are flanked by spun glass Vitrex retainers, against which are placed slotted plastic plate protectors. The latter, in turn, are held apart by microporous rubber separators.

Dimensions of the new batteries range from 4½ in. to 11⅝ in. in length. Width and height have been standardized at 7⁵⁄₁₆ in. x 10⅝ in. in all four available sizes.

Socket Wrench Repair Kit

Two ratchet repair kits for the model B-51 or ⅜-in. square drive and the model S-51 or ½-in. square drive Superratchets have been added to the line of accessories manufactured by J. H. Williams & Co., Buffalo 7, N. Y.

These kits contain a complete assortment of replacement parts and a special spanner wrench. This wrench fits the retaining ring (gland), the only part requiring a tool for assembly or disassembly. Printed instructions are included in each kit.

Light Weight Electric Spray Gun

A trigger action spray gun which is light in weight has been designed by the Champion Implement Corporation, New York 17. This high speed electric pumping device delivers over 90 lb. pressure at 7,200 strokes per min. No compressor is needed.

The heavy duty spray gun can be used for spraying paints, lacquers, enamels, varnishes, chemicals, etc. It is said to be suitable for all types of work including painting, refinishing, touch-up work, cover-up coats or rustproofing.

This gun is a self-contained appliance made of stainless steel with a vibrator motor in the handle. A 25-oz. glass jar and 8 ft. of cord are supplied with every model. It uses a.c. power from a 110 volt circuit.

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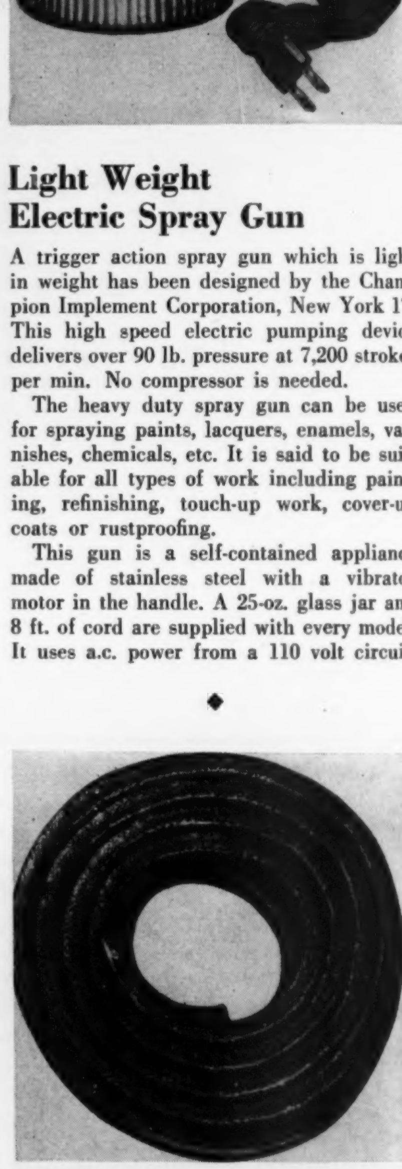


Acid Resisting Plastic Packing

An extruded Teflon plastic packing, designed for packing applications, has been perfected and marketed by the Flexrock Company, Philadelphia 4, Pa. It was perfected for use in centrifugal pumps handling acids, caustics and hard-to-handle solvents, operating at varying speeds from low to 3,500 r.p.m. and higher.

Called Teflon Plastic Packing No. 403, the product is composed of shredded Tef-

lon, blue asbestos, combined with binders and lubricants, extruded into an open cotton yarn jacket which confines it and makes installation easy.

High Pressure Booster Gun

An automatic high pressure booster gun, known as the Model 1120, has been introduced to industry. This unit is designed for the following applications: 1. Lubrication of bearings requiring injection of a small quantity of lubricant at extremely high pressure. 2. An auxiliary high pressure lubricator to service bearings requiring injection of a limited quantity of special purpose lubricants. 3. Cracking clogged bearings on equipment without the use of power-operated gun.

The gun, made available by the Lincoln Engineering Company, St. Louis 20, Mo., provides a complete range of pressures up to 10,000 lb. per sq. in. One-hand operation eliminates fatigue and the unit weighs only 2 lb.

A long hydraulic-coupler extension permits reaching deep-seated and hard-to-reach fittings. The device handles all pressure gun lubricants in any weather and it holds 2½ oz. It can be cleaned by removing only one outlet check and there are no packings to replace.

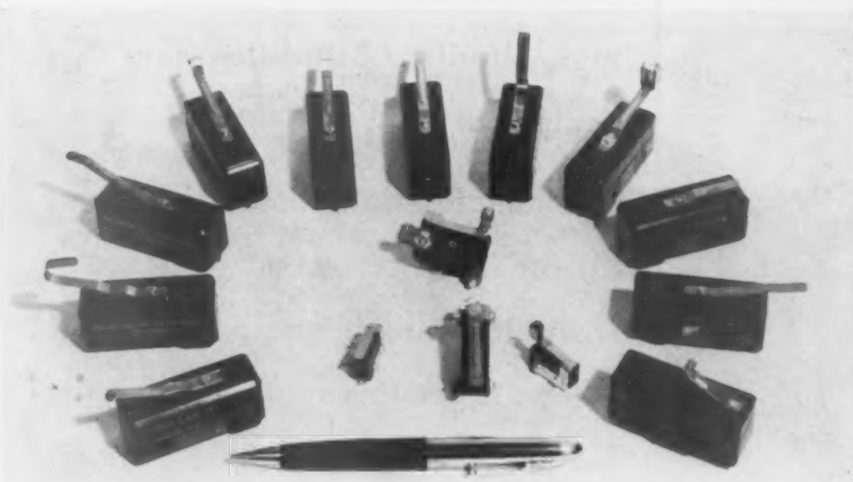
All-Purpose Pneumatic Tools

A line of standardized tools for ready assembly, featuring a new rotary air motor to provide maximum output at standard air-line pressures have been announced. Introduced by the Independent Pneumatic Tool Company, Aurora, Ill., the line includes lightweight Thor pneumatic screwdrivers, nut setters and grinders.

A total of 85 different sizes, ranging from a 1 lb. 1 oz. grinder to a 2 lb. 11 oz. angle screwdriver are offered. These No. 2 class tools feature interchangeability of housings, handles and attachments.

The drill line has 31 sizes, including angle attachment models in 30, 45 and 90 deg. units along with the straight models. Speeds range from 850 to 14,000 r.p.m. for drilling in aluminum.

The screwdrivers and nut setters number 48 sizes, 28 of them direct angle types in 25 and 90 deg. models. These drivers will handle up to No. 12 wood screws and ¼ in. machine screws or nuts.



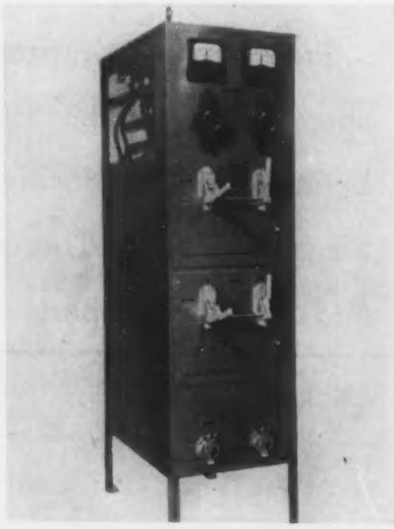
Precision Miniature Switches

Precision miniature switches are now being manufactured, that will open and close as many as 100 million times. This was made possible by a new type of alloy known as Armco 17-7 PH (precipitation hardening) stainless steel.

Operating clearances in these switches are often critically small, and even a slight change in position of the actuator may render the switch useless.

Drift characteristics of 17-7 PH stainless are reported to be superior to any other material tested. Switch life has also been greatly lengthened because of the exceptional flexure endurance of the metal. Another advantage is marked corrosion resistance, which further contributes to long, dependable service.

Some standard types of stainless steels, while durable, have poor spring characteristics when soft enough to form properly. They take a permanent set after relatively few operations. Other standard types of stainless with good spring characteristics will crack when severely worked. 17-7 PH stainless has solved these problems, according to the manufacturer, Micro Switch Division of Minneapolis-Honeywell Regulator Company, Freeport, Ill.



Battery Charging and Discharging Cubicle

A two-circuit battery cubicle has been announced by the Curtis Development & Manufacturing Company, 3266 North 33rd street, Milwaukee, Wisc. Its design is based on the operating experience of a number of midwest railroads.

The new unit, being of the two-circuit type, permits charging on one circuit and discharging on the other simultaneously, and is claimed to have increased the battery shop output approximately 55 per cent where it has been employed. The savings are effected in man-hours through the elimination of attendant's travel time between batteries and controls.

Designed for use on batteries for railway car lighting and air conditioning, diesel-electric locomotives and motive power service, the cubicle is available in two models. Model No. 32 provides for manual control of charge or discharge of 32-volt batteries. The model No. 64-110 cubicle is used for 64-volt batteries, and will also handle one 110-volt lead or Edison battery in split combinations on each circuit. Provisions are made for discharging the split combinations in series, or two 64-volt batteries may be charged or discharged independently.

Wall Scuff Plates

Permanent, three dimensional panels of Rigid-Tex metal have been introduced by the Rigidized Metals Corporation, Buffalo 3, N. Y.

When installed, travelers can prop their feet on the walls and relax without the worry of dents, scratches or scuffs. These panels require no maintenance except simple cleaning. No painting or polishing is needed.

The metals have increased flexural rigidity to give added strength resulting in gage reductions. Its surfaces are without glare.

Deep Drawn Steel Cleaning Compound

A compound which is said to completely remove oil, grease and dirt from all ferrous parts has been made available. Developed for use as a precleaner for steel that is to be drawn or extruded, it is a product of the Detrex Corporation, Detroit 32.

Known as Detrex 61, the solution is used at a concentration from 6 to 10 oz. per gal. of water in a soak tank, at approximately 190 deg. F. It has high wetting properties and is free rinsing. It does not contain fatty acids or resin soaps.

Worm Face Gear Grinder Wheels

Popular make gradings and pitches of worm face profiled gear grinding wheels have been marketed by the Jerpbak-Bayless Company, Solon, Ohio. According to the manufacturer, the use of these wheels will cut set-up time to a minimum, save man-hours and critical machine time.

These profiled wheels are formed, with proper root clearances, minimizing root crushing and require a minimum of dressing. The grinding wheel is readily remounted on a machine because the worm face profile is held square and parallel with the bore and face. Each grinding wheel is marked with the proper pitch and form for easy identification.

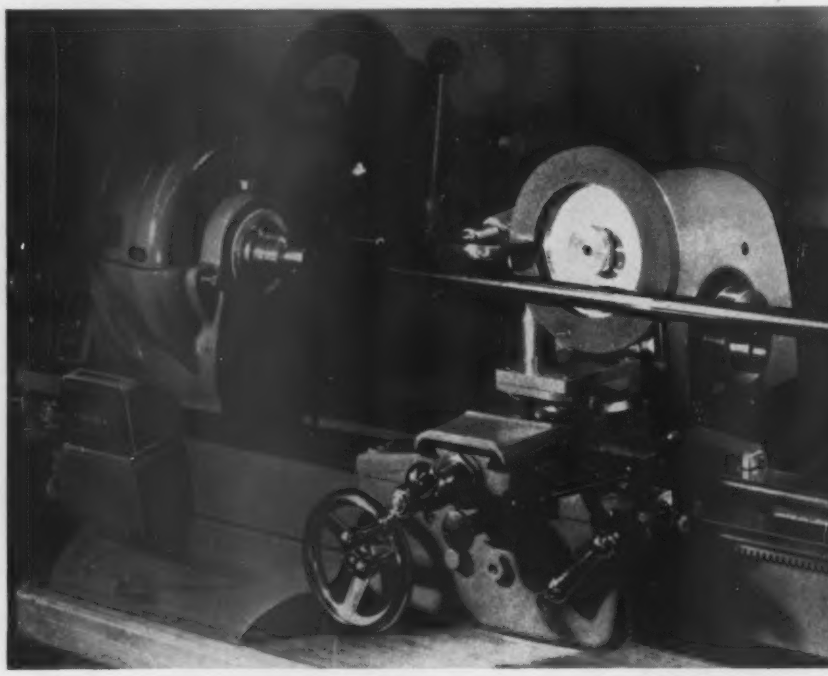
Write-On-It Tape

A marking tape is now being made by the Labelon Tape Company, Rochester, N. Y., on which circuit data can be noted and the tape applied directly to panels (as shown in the illustration), to circuit breakers, switches, fuses, wall outlets and as flags to wires and drop cords. The tape is pressure sensitive, sticking without moistening to any dry and comparatively smooth surface.

Labelon tape may be written on with a pencil or any pointed instrument,—but the writing is not on the surface of the tape. It appears beneath a transparent plastic outer layer which protects it against smudging, dust, dirt, oil, water and chemicals

It is not affected by temperatures between —40 deg. F. and 160 deg. F. It can be stripped off one surface and reapplied to another a number of times without leaving a mark or losing its adhesive quality.

Four standard colors, blue, green, black and red, are available, providing an aid to coding in widths from $\frac{5}{16}$ in. to 2 in.



Cylindrical Parts Abrasion Tester

An abrasion tester for rating the wear resistance of protective finishes such as black oxidized or electroplated coatings, plastic and enamel applied to tubing or other cylindrical parts or test pieces has been introduced by the Taber Instrument Corporation, North Tonawanda, N. Y.

Known as the model W-3981, the unit is fully adjustable to take cylindrical specimens from ½ to 6 in. in dia. and 8 to 36 in. in length. The width of the wear track is normally 1 in. However, the face of the abrading medium can be narrowed to wear a track only ½ in. in width, where required.

The abrasion resistance is reported as "the number of wear cycles" the surface will withstand before abrading. These wear cycles are indicated by an electric counter. One wear cycle is one complete revolution of the abradant wheel.

Portable Winch-Hoist

A new $1\frac{1}{2}$ ton portable winch-hoist, weighing $8\frac{1}{2}$ lb., has been introduced to meet the requirements of railway shops, and construction work. Named the Lug-All, the unit has a 30 to 1 power ratio and is tested to a 100 per cent overload.

Features of this device, made by The Lug-All Company, Wynnewood, Pa., include preformed flexible aircraft cable, stainless steel fittings and springs, plus oiled bearings. Its handle is reversible and acts as a safety factor to protect the operator.

A combination of three swivel hooks and a built-in pulley block allows work to be performed around corners and as close as 10-in. at the $\frac{3}{4}$-ton rating. The hoist can be operated in any position and may be set forward, reverse or free-wheeling. Locking is automatic and there is no brake to slip.

◆

Brazing Alloy

A new copper-phosphorous-silver alloy, Phos-Silver, for efficient brazing of copper, brass and bronze is available from the Westinghouse Electric Corporation. Fluidity and good wetting properties enable this new alloy to penetrate tight-fitting joints.

Phos-Silver can be used with any of the common brazing methods for brazing on copper or copper alloys, and is suited for applications where brazing temperatures are critical. Its brazing temperature is 1,225 deg. F. to 1,275 deg. F. No flux is needed in copper-to-copper brazing.

A typical example of torch brazing with Phos-silver is shown in the illustration.

◆

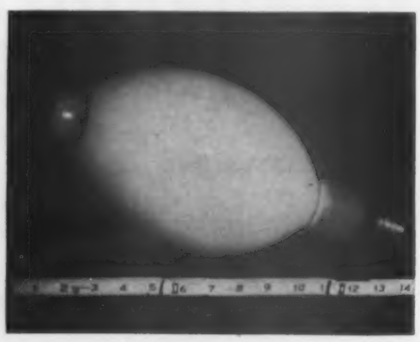
Diamond Lapping Wheel Compound

Cutting tool life can be increased 3 to 6 times and sharp, finish-lapped cutting edges obtained, according to the manufacturer, through the use of a method of wheel lapping developed by Penn Scientific Products Co., Philadelphia 24.

The product called Spectrum Diamond Lapping Compound, is available in any desired grit size and sub-sieve sizes, and is designed for application to lapping wheels. These wheels are interchangeable on all tool grinders.

The wheel lap is packaged in kits and contain the diamond compound, lapping wheel, lapping oil, applicator and wheel charging roller. A variety of wheels and lapping compounds in 12 standard grit sizes may be purchased separately.

◆



A 1,000-Watt Mercury Lamp

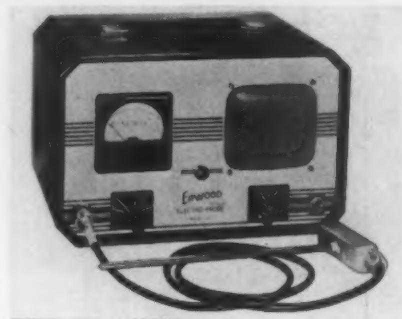
The General Electric Company has announced a 1,000-watt mercury lamp for general industrial use where medium- or high-bay lighting is desired. The new lamps will be used in plants which produce heavy equipment, in railroad shops, in foundries, and for street lighting and floodlighting.

Producing 52,000 lumens, or 52 lumens per watt, the lamp is the most efficient of G.E.'s general lighting mercury lamps. It is designed to fill in the gap between the 400- and 3,000-watt lamps in the mercury lamp line. Its life rating is 3,000 hr. at five burning hours per start, and 4,000 hr. at 10 burning hours per start. It operates satisfactorily in any burning position.

Developed in the G.E. Lamp Development Laboratories at Nela Park in Cleveland, the new light source was made to operate on 440-480 volts for highest efficiency. This voltage also makes it possible to operate the lamp with a simple ballast.

Designated the A15, the lamp has an overall length of $14\frac{1}{4}$ in., and its heat-resistant outer bulb is $3\frac{1}{2}$ in. in diameter.

◆



Electronic Ear

A device called an Electro-Probe which amplifies sounds in machines has been produced by Erwood, Inc., 1770 Berteau street, Chicago 13, Incorporating a pick-up probe and three-stage amplifier, the device becomes an electronic "third ears", supersensitive to vibrations at the point of contact but unaffected by airborne noises. Speaker and headphones provide audible comparison of vibration sounds within a range of 60 decibels. A calibrated meter provides visual indication.

Designed to be a relative indicating device, the probe helps maintainers to detect and diagnose trouble developing in running motors or machines before failure occurs. Once a reading has been established for an acceptable condition, other tests can be made by means of the meter only.

The Electro-probe is also said to be useful for locating leaks or stoppages in liquid piping systems, locating causes of structural vibrations, etc. It operates on 110-120-volt a.c. power and consumes 36 watts. Dimensions are 10 in. x $6\frac{1}{2}$ in. x $5\frac{3}{4}$ in., and the shipping weight is 14 lb.

◆

Electrical Tapes

A new line of electrical tapes has been introduced by Ideal Industries, Inc., 1561 Park avenue, Sycamore, Ill. Included are a four-coated, ravel-free friction tape; a quick-fusing, high-dielectric rubber tape; and a two-in-one plastic tape.

The plastic tape provides both insulation and protection against weather and mechanical abuse. The vinyl plastic body is strong mechanically and has a dielectric strength of over 8,000 volts. It is highly resistant to acids, alkalies, corrosive salts, water, oils, greases and alcohols. It is not affected by weather and retains its tackiness well at low temperatures.

The minimum thickness (.007 in.) of the plastic tape, plus its two-way stretch lets it fit snugly to irregular shapes and surfaces. A few layers provide insulation without bulk. Both tape and adhesive are free of corrosive substances.

(New Devices continued on page 150)

NEWS

Correction Notice—

Attention has been called to the fact that the statement was made in an article entitled, "Diesel Fueling Alarm Signal" which appeared on page 89 of the June, 1951, issue that: "The whistle in the alarm signal operates at a pressure of 0.5 oz. per sq. in." This is in error. The whistle operating pressure in the alarm signal described in the above mentioned article is 4.0 oz. per sq. in.

CNR Tests New Mechanical Reefer

A NEW type of mechanical refrigerator car, said to be the first of its kind in North America, has been completed by Canadian National shops at Montreal. On running tests, company officers reportedly expect the car's mechanical refrigeration equipment to maintain an interior temperature of minus 10 deg. F., which is considerably below the temperature normally obtained in standard ice refrigerator cars.

A. C. Melanson, chief of motive power and car equipment of the CNR, said the car is the first of its type to be built with refrigeration equipment suspended beneath the car body—an innovation made possible by suspension gear and an air circulating system both designed by engineers of the railroad's car department.

The new car can also be heated when necessary, by transferring power from the cooling equipment to a bank of electric heaters in the ceiling.

N&W To Test Diesel In Freight Service

THE Norfolk & Western is planning to test a diesel locomotive in freight service.

During the fuel shortage created by a miners' strike several years ago, the N&W made extensive tests of diesel locomotives in passenger service, using Southern engines on trains operated jointly with the Southern between Lynchburg and Bristol. "As a result of this test the N&W found no justification for changing from the type of locomotives it regularly used," a spokesman for the road said.

Main line trackage being used in the new tests extends from Bluefield, W. Va., to North Fork, and includes the new Elkhorn tunnel and the just completed Elkhorn grade track relocation west of the tunnel.

The N&W's new coal burning steam electric locomotive is expected to be under actual operating tests in less than a year. This locomotive, being constructed by three manufacturers, will have a water-tube type boiler in which the working steam pressure will be more than twice the steam

(*Continued on page 122*)

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I. C. C. M-211 AND M-240)

Item No.		Month of April 1952	Month of April 1951	4 months ended with April 1952	4 months ended with April 1951
3	Road locomotive miles (000) (M-211):				
3-05	Total, steam	16,800	26,341	75,492	108,774
3-06	Total, Diesel-electric	26,531	21,784	104,695	82,750
3-07	Total, electric	771	858	3,170	3,274
3-04	Total, locomotive-miles	44,120	48,984	183,393	194,815
4	Car-miles (000,000) (M-211):				
4-03	Loaded, total	1,592	1,754	6,598	6,855
4-06	Empty, total	880	920	3,560	3,369
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6-01	Total in coal-burning steam locomotive trains	29,751	45,778	135,653	184,545
6-02	Total in oil-burning steam locomotive trains	7,947	13,048	33,262	48,498
6-03	Total in Diesel-electric locomotive trains	73,662	61,472	289,660	230,509
6-04	Total in electric locomotive trains	2,151	2,330	8,797	8,940
6-06	Total in all trains	113,589	122,635	467,547	472,573
10	Averages per train-mile (excluding light trains) (M-211):				
10-01	Locomotive-miles (principal and helper)	1.03	1.04	1.04	1.05
10-02	Loaded freight car-miles	39.40	39.70	39.60	39.20
10-03	Empty freight car-miles	21.80	20.80	21.30	19.20
10-04	Total freight car-miles (excluding caboose)	61.20	60.50	60.90	58.40
10-05	Gross ton-miles (excluding locomotive and tender)	2,815	2,773	2,802	2,700
10-06	Net ton-miles	1,292	1,286	1,300	1,261
12	Net ton-miles per loaded car-mile (M-211)	32.80	32.40	32.90	32.20
13	Car-mile ratios (M-211):				
13-03	Per cent loaded of total freight car-miles	64.40	65.60	65.00	67.00
14	Averages per train hour (M-211):				
14-01	Train miles	17.70	17.30	17.50	16.80
14-02	Gross ton-miles (excluding locomotive and tender)	49,289	47,397	48,415	44,769
14	Car-miles per freight car day (M-240):				
14-01	Serviceable	44.50	47.70	45.10	45.90
14-02	All	42.30	45.60	43.00	43.80
15	Average net ton-miles per freight car-day (M-240)	893	970	919	947
17	Per cent of home cars of total freight cars on the line (M-240)	44.30	36.50	42.00	35.30

PASSENGER SERVICE (DATA FROM I. C. C. M-213)

Item No.		Month of April 1952	Month of April 1951	4 months ended with April 1952	4 months ended with April 1951
3	Road motive-power miles (000):				
3-05	Steam	7,015	10,307	30,817	44,537
3-06	Diesel-electric	18,061	15,821	71,724	62,052
3-07	Electric	1,625	1,601	6,598	6,452
3-04	Total	26,700	27,729	109,146	113,040
4	Passenger-train car-miles (000):				
4-08	Total in all locomotive-propelled trains	266,811	269,197	1,083,059	1,090,212
4-09	Total in coal-burning steam locomotive trains	37,508	53,800	164,010	235,591
4-10	Total in oil-burning steam locomotive trains	25,017	32,486	103,398	134,358
4-11	Total in Diesel-electric locomotive trains	186,083	165,621	742,025	651,301
12	Total car-miles per train-miles	9.77	9.52	9.74	9.51

YARD SERVICE (DATA FROM I. C. C. M-215)

Item No.		Month of April 1952	Month of April 1951	4 months ended with April 1952	4 months ended with April 1951
1	Freight yard switching locomotive-hours (000):				
1-01	Steam, coal-burning	848	1,237	3,720	5,325
1-02	Steam, oil-burning	168	248	683	989
1-03	Diesel-electric[1]	3,113	2,895	12,627	11,451
1-06	Total	4,154	4,404	17,124	17,870
2	Passenger yard switching hours (000):				
2-01	Steam, coal-burning	29	50	132	211
2-02	Steam, oil-burning	11	13	47	54
2-03	Diesel-electric[1]	254	239	1,022	952
2-06	Total	328	337	1,336	1,351
3	Hours per yard locomotive-day:				
3-01	Steam	7.10	7.80	7.30	8.20
3-02	Diesel-electric	16.60	17.60	16.80	17.70
3-05	Serviceable	14.40	14.40	14.60	14.60
3-06	All locomotives (serviceable, unserviceable and stored)	12.50	12.40	12.60	12.60
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.80	1.73	1.79	1.79
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.76	0.78	0.76	0.77

[1] Excludes B and trailing A units.

WHEN SNOW FLIES...

Be Prepared With COMMONWEALTH PILOT SNOW PLOWS

COMMONWEALTH One-Piece Pilot Snow Plows applied to diesel road locomotives have proved of great value in keeping rails clear of drifting snow without the costly repeated use of large snow plow equipment.

These rugged cast steel pilot plows can be easily applied, removed and reapplied. Also, as a permanent application, they help solve year round operating problems by serving as strong deflecting pilots which clear the way of objects, substantially reducing the possibility of accidents or derailments. They may be used without interference with normal coupling operations.

Act now to reduce your next winter's operating costs with **COMMONWEALTH** One-Piece Cast Steel Pilot Snow Plows.

Large numbers of **COMMONWEALTH** *pilot snow plows of special design have also been applied to Diesel switchers and road switchers.*

Commonwealth Pilot Snow Plow applied to Road Locomotive

Commonwealth Cast Steel Pilot Snow Plow

GENERAL STEEL CASTINGS

GRANITE CITY, ILL. EDDYSTONE, PA.

pressure carried by the average conventional steam locomotive boiler.

With several other railroads and mining companies, the N&W also is participating in development of a locomotive which will use coal as fuel in a gas type combustion turbo-electric drive arrangement, which it is hoped will give considerably higher thermal efficiency than present coal-burning locomotives.

Electro-Motive Loses Allocations Appeal

THE appeal of the Electro-Motive Division, General Motors Corporation, for revision of the formula under which controlled materials are allocated to builders of railroad-type diesel-electric locomotives has been denied by the Appeals Board of the National Production Authority.

Under the formula which it sought to have revised, Electro-Motive is allocated controlled materials in amounts calculated to provide for production by it of 51.4 per cent of the diesel units produced by all builders. This formula was a revision of a previous one under which Electro-Motive's proportion was 59.4 per cent.

The earlier formula covered only allocations for diesel locomotives for service on railroads in this country, and only four builders were involved. The new formula provides for nine companies, thus covering builders of diesel-electrics for all uses—U. S. railroad, industrial, and export. The formula is based on company outputs during the years 1948, 1949 and 1950.

Among other pleadings in its presentation to the Appeals Board, Electro-Motive objected to this base period. It said that it spent $35 million to expand its production facilities about 75 per cent during the 1948-1951 period.

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE AUGUST ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	*No. of units*	*Horse power*	*Service*	*Builder*
Baltimore & Ohio	13[1]	1,500	Road switch	Electro-Motive
	18A[1]	1,500	Road freight	Electro-Motive
	9B[1]	1,500	Road freight	Electro-Motive
	6A[1]	1,600	Road freight	Alco-G. E.
	4B[1]	1,600	Road freight	Alco-G. E.
	1[1]	1,600	Road switch	Baldwin-Lima-Hamilton
	A[1]	1,600	Road freight	Baldwin-Lima-Hamilton
	6B[1]	1,600	Road freight	Baldwin-Lima-Hamilton
	2[1]	1,600	Road switch	Fairbanks, Morse
Northern Pacific	3[2]	1,600	Road switch	Alco-G. E.
	3[2]	1,600	Switch	Alco-G. E.
	1[2]	1,500	Road switch	Electro-Motive
	1[2]	1,200	Switch	Electro-Motive
Pennsylvania-Reading Seashore Lines	4[3]	1,600	Road switch	Baldwin-Lima-Hamilton

FREIGHT-CAR ORDERS

Road	*No. of cars*	*Type of car*	*Builder*
Atlantic Coast Line	12	50-ton air dump	Baldwin-Lima-Hamilton
Chesapeake & Ohio	400[4]	70-ton gondola	American Car & Fdry.
	300[4]	50-ton gondola	American Car & Fdry.
Grand Trunk Western	100[5]	70-ton gondola	General American
Great Northern	1,000[6]	Box	Company shops
Kennecott Copper Corp.	55[7]	90-ton air dump	Baldwin-Lima-Hamilton
Nashville, Chattanooga & St. Louis	75[8]	Covered hopper	Pullman-Standard
Western Fruit Express Co.	50[9]	Refrigerator	Company shops
Transportation Corps	32	50-ton flat	Greenville Steel Car

FREIGHT-CAR INQUIRIES

Atlantic Coast Line	100-1,000	50-ton pulpwood
	100-1,500	70-ton cement-phosphate rock

PASSENGER-CAR ORDERS

Road	*No. of cars*	*Type of car*	*Builder*
Canadian Pacific	40[10]	Coaches	Canadian Car & Fdry.
New York, New Haven & Hartford	26[11]	Rail-diesel	Budd Co.

[1] Fairbanks, Morse units for delivery in October; the others, in the first quarter of 1953.
[2] Alco-GE units for delivery in October; Electro-Motive units for delivery in December.
[3] Approximate cost $672,000. Delivery expected in the first quarter of 1953.
[4] Delivery scheduled for the second quarter of 1953.
[5] Cost, $649,464.
[6] Average cost $6,305 each. Fifty cars will be equipped for operation in passenger trains.
[7] To be equipped with roller-bearing trucks.
[8] These cars in addition to 25 similar cars now on order with the same company.
[9] Construction authorized by parent company, the Great Northern, at a cost of $18,000 each. All cars to be mechanically refrigerated and heavily insulated for handling frozen foods. To be equipped with air-circulating fans and 6-ft. sliding doors.
[10] Estimated cost $4,000,000. Cars, for suburban service, to be of steel construction and equipped with roller bearings. Aluminum-framed windows of Solex heat-absorbing glass will open from top downward.
[11] These new units will bring road's total RDC fleet up to 40 cars.

More Time For AB Brake Installations

DIVISION 3 of the Interstate Commerce Commission has given railroads and other car owners more time to complete installation of AB brakes on their freight cars. A July 23 order in the No. 13528 proceedings set back the deadline date six months—from June 30, 1952, until December 31, 1952.

The I. C. C. also announced that Commissioner Patterson will hold a hearing at Chicago in connection with equipping non-interchange cars as required by the commission. The present deadline for equipping such cars is December 31, 1952.

The time for carriers desiring additional time expired August 25.

SUMMARY OF MONTHLY HOT BOX REPORTS

	Foreign and system freight car mileage (total)	Cars set off between division terminals account hot boxes			Miles per hot box car set off between division terminals
		System	Foreign	Total	
July, 1950	2,745,932,894	....	.....	23,957	114,619
August, 1950	2,937,455,020	7,422	15,490	22,912	128,206
September, 1950	2,974,297,739	6,541	12,881	19,422	153,141
October, 1950	3,165,997,915	4,343	8,935	13,278	238,439
November, 1950	2,868,871,913	2,536	5,331	7,867	364,672
December, 1950	2,813,042,212	2,278	5,968	8,246	341,140
January, 1951	2,840,847,511	2,870	8,436	11,306	251,269
February, 1951	2,425,226,454	4,528	14,063	18,591	130,452
March, 1951	3,063,173,942	3,667	10,078	13,745	222,857
April 1951	2,996,562,763	3,702	8,914	12,616	237,521
May, 1951	3,013,634,781	5,631	13,737	19,368	155,599
June, 1951	2,874,873,495	7,074	15,376	22,450	128,057
July, 1951	2,768,920,095	8,886	18,823	27,709	99,929
August, 1951	3,009,371,111	9,023	19,092	28,115	107,038
September, 1951	2,925,570,545	6,472	13,565	20,037	146,008
October, 1951	3,116,490,095	4,131	9,053	13,184	236,384
November, 1951	2,939,503,144	2,022	4,405	6,427	457,368
December, 1951	2,752,316,133	2,130	5,398	7,528	365,611
January, 1952	2,824,298,630	3,208	7,197	10,405	271,437
February, 1952	2,809,162,671	2,723	6,473	9,196	305,477
March, 1952	2,943,812,727	2,594	5,877	8,471	347,517
April, 1952	2,766,313,714	3,826	7,759	11,585	238,784

Ownership of Diesel Units Exceeds Steam-Engine Total

DIESEL ownership as expressed in power units exceeded ownership of steam locomotives, for the first time, during May. This was noted by Chairman Arthur H. Gass of the Car Service Division, Association of American Railroads, in a recent monthly review of "The National Transportation Situation," whose figures showed that Class I railroads owned 19,082 diesel-electric power units on June 1. On the same date, they owned 18,489 steam locomotives.

Miscellaneous Publications

TRAIN HEATING SYSTEMS.—Vapor Heating Corporation, 4501 West Sixteenth street, Chicago 23. Strip film, "Unizone-Moduzone-Aquazone," available for showing to groups of railroad men. Film has 59 illustrations of new train heating systems, with description on 33⅓ r.p.m. records. Show time 27 min. Described also in Bulletin 565 Rev. "B".

MEEHANITE CASTINGS.—Meehanite Metal Corporation, New Rochelle, N. Y. Thirty-minute sound slide film entitled "Meehanite Castings Serve All Industry," available

(*Continued on p. 126*)

Historic Builder

of the West...

Southern Pacific lubricates
this 4500 hp freight locomotive
with Sinclair GASCON Oil.

ON a never-to-be-forgotten day in 1869 the Southern Pacific's pioneer ancestor, the Central Pacific, met the Union Pacific at Promontory, Utah, to make trans-continental rail travel a reality.

From this historic opening of America's Western Empire down to the present, SP has been a pioneer in progress. Out of its vision and business courage have come today's fast freights and the magnificent streamliners "City of San Francisco," "Cascade" and "Shasta Daylight." During the past 33 years of Southern Pacific growth, Sinclair has played an important part in the vital factor of lubrication. Sinclair GASCON® OILS are used on many SP Diesels.

Yes, to get the utmost in *all* types of Diesel operation, America's top railroads and locomotive manufacturers agree that Sinclair GASCON OILS are unsurpassed. Today more than 80 U.S. railroads use these fine lubricants.

SINCLAIR RAILROAD LUBRICANTS

SINCLAIR REFINING COMPANY, RAILWAY SALES • NEW YORK • CHICAGO • ST. LOUIS • HOUSTON

on loan basis. Film designed for showing to engineering groups, societies, employee meetings, or others interested in the use of high-property iron castings for component parts. Film illustrates applications in nearly every major industry and is accompanied by descriptive narration.

"Make Your Diesel Traction Repairs Stay Repaired"—Westinghouse Electric Corporation, Film Division, Box 2099, Pittsburgh 30. Ten-minute sound film follows a diesel-electric traction motor through a shop typical of the repair shops Westinghouse maintains throughout the country. Standardized repair procedure, dependable workmanship through quality control, speed, and economy are all illustrated as the motor is inspected, repaired and tested. Arrangements for showing the film can be made also through a local Westinghouse representative.

SUPPLY TRADE NOTES

Garlock Packing Company.—*Joe H. Dunlevy* has been appointed district manager of the Los Angeles office of Garlock Packing at 2303 E. Eighth street, succeeding *Clarence W. Harmon*, who has retired because of ill health.

From 1919 to 1929 Mr. Dunlevy was a Garlock sales representative operating from Cleveland, Ohio office. Then for two years he acted as a special representative for the vice president in charges of sales. Since 1930 his headquarters have been at Palmyra, N. Y., where he served as a consultant on mechanical packing problems for the entire company as well as Garlock's special representative contacting the Army and Navy in Washington, D. C. Prior to his Garlock service Mr. Dunlevy was with the Erie and New York Central as enginehouse foreman at various terminal points.

J. H. Dunlevy

◆

Joseph T. Ryerson & Son.—*John W. Queen* has been appointed manager of the Cleveland plant of Joseph T. Ryerson & Son, effective August 15. Mr. Queen has been in Cleveland for the past two months, assisting *William O. Springer*, plant manager since 1945, who has been transferred to the east for special administrative duties while awaiting reassignment in the organization.

◆

Binks Manufacturing Company.—The Cleveland offices and warehouse of the Binks Manufacturing Company have been moved to new and larger quarters at 1241 West ninth street, Cleveland 13. *B. R. Fulton*, district manager, heads the new office. *H. G. Pankratz* is district engineer. Sales representatives in the Cleveland territory are *George Sherwood* (Cleveland), *George Mally* (Indianapolis), and *John Homan* (Cincinnati).

◆

Pacific Lumber Company.—*William G. Van Beckum* has been appointed director of research and development for the Pacific Lumber Company, continuing development in the manufacture of redwood bark fiber for use in lubricating oil filters for diesel locomotives. Since 1948, Mr. Van Beckum has been manager of technical service and assistant sales manager, Special Products Division, Weyerhaeuser Timber Company.

W. G. Van Beckum

Mr. Van Beckum, a graduate of St. Norbert College and the University of Wisconsin, worked under a TAPPI Fellowship for three years at the U. S. Forest Products Laboratory at Madison, Wis. In 1939 he joined the Wood Conversion Company, and in 1942 became chief of the chemistry section of the Weyerhaeuser Development Department, of which he became assistant manager in 1946.

◆

Union Spring & Manufacturing Co.—*H. C. Bughman, Jr.*, has been elected chairman of the board. *W. F. McCabe* president and *Clarence Abitz*, vice-president of the Union Spring & Manufacturing Co.

◆

Apex Railway Products Company.—The Apex Railway Products Company has announced acquisition of a controlling interest in the *M. & J. Diesel Locomotive Filter Corp.*, of Chicago. There will be no change in the present operation of the M. & J. organization; *Jack P. Morris* will continue as president, *R. W. McNeily* as vice-president.

◆

Graybar Electric Company.—*J. W. Horne* has been appointed manager of the Graybar Electric Company's Norfolk, Va., branch. Mr. Horne, who formerly was manager at Memphis, Tenn., joined Graybar in 1933. *W. J. Bery* succeeds Mr. Horne at Memphis.

◆

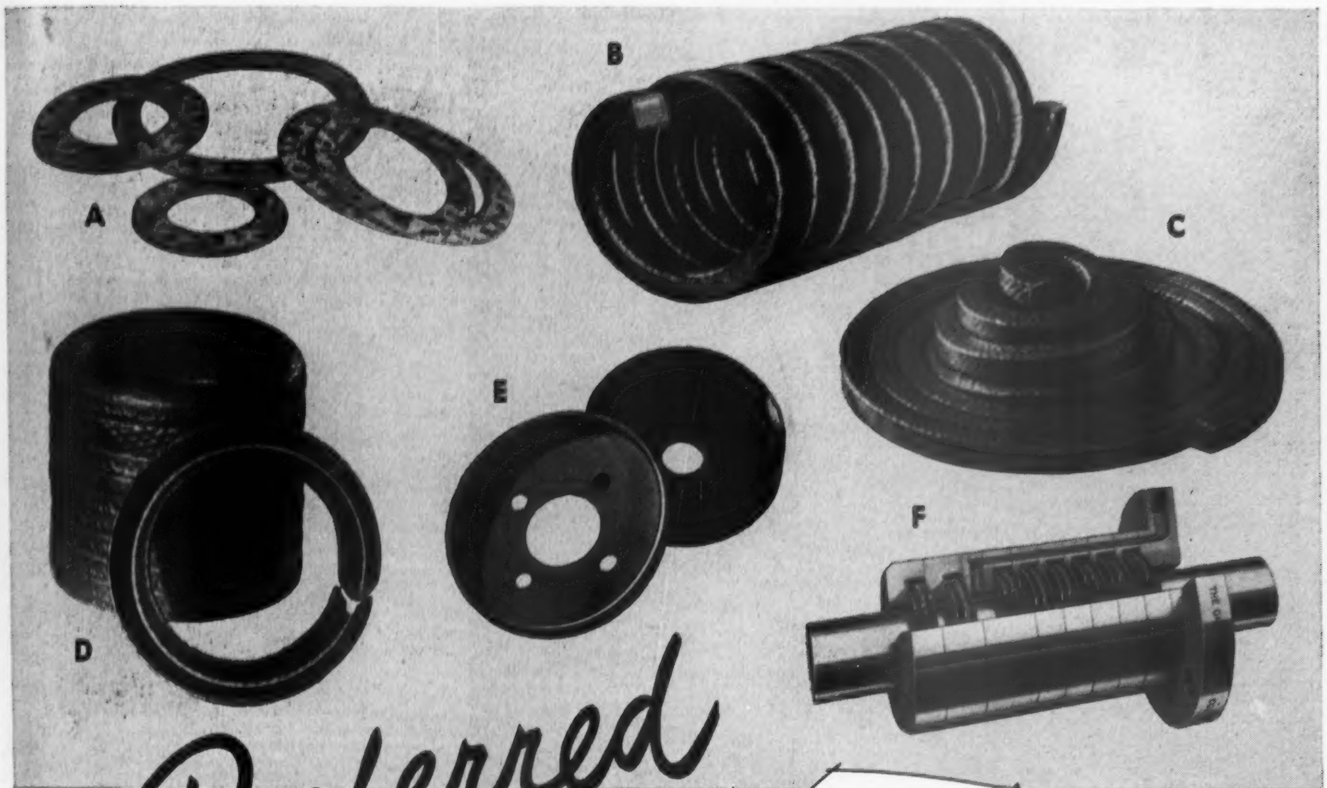
Union Carbide & Carbon Corp.—*Arthur C. Bryan* has been appointed vice-president in charge of sales for the *National Carbon Company*, a division of Union Carbide & Carbon Corp.

Mr. Bryan joined National Carbon in 1935 as an industrial salesman in the Chicago office. In 1940 he was appointed a district manager in the New York office, and later moved to Cleveland as assistant manager of the Carbon sales division there. Subsequently he was division manager of the Kansas City sales office. He returned to New York as assistant general sales manager where he became general sales manager in 1949.

Arthur C. Bryan

◆

Templeton, Kenly & Co.—*Phillip H. McManus*, formerly general sales manager, has been elected vice-president in charge of sales. Mr. McManus, in addition to directing sales, also will travel in far west-



Preferred — because of:

1. Research
Garlock research brings improved products to meet changing needs.

2. Quality
High quality is assured by quality-controlled construction throughout.

3. Service
Helpful service calls by Garlock representatives and complete factory co-operation.

4. Complete Line
There are Garlock products for every kind and type of service.

5. Long Life
Garlock products give long, dependable service because of their uniform fine quality.

In a recent nation-wide industrial survey over half of those interviewed gave GARLOCK as their first choice for packings and gaskets. The main factors influencing their choice are listed at the right.

Illustrated above are a few widely used Garlock products: **A.** Garlock 950 Gaskets, cut from Compressed Asbestos Sheet; **B.** Garlock 150 High Pressure Packing; **C.** Garlock 731 Lattice-Braid Coil Packing; **D.** Garlock 430 *Chevron** Packing; **E.** Garlock *Bitan** Leather Cups; **F.** Garlock 875 Gas Compressor Metal Packing—all of uniform high quality for *dependable* performance.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK

In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

*REGISTERED TRADEMARK

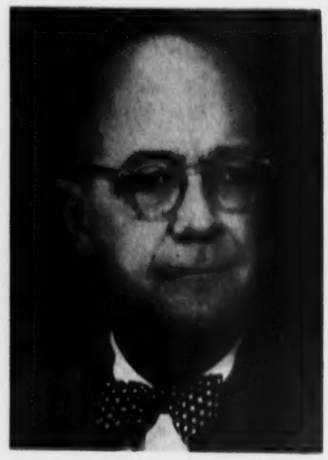
GARLOCK

**PACKINGS, GASKETS, OIL SEALS,
MECHANICAL SEALS,
RUBBER EXPANSION JOINTS**

ern territory. *William H. Zepp* will assist Mr. McManus in Illinois, Indiana, Iowa, Kansas, Michigan, Missouri and Wisconsin.

◆

GUSTIN-BACON MANUFACTURING COMPANY.—*F. H. Ebbert* has been appointed vice-president and general sales manager, in charge of the company's glass-fiber insulation products, industrial, railroad, and automotive sales divisions. Mr. Ebbert was



F. H. Ebbert

previously vice-president and sales manager of the company's Automotive Division. *George M. Seymour*, has been appointed manager of all railroad sales. Mr. Seymour succeeds *Fred C. Fuller*, who has retired after holding that post for 40 years.

G. M. Seymour

James G. Holdren has been appointed sales representative of the railroad division of the Gustin-Bacon Manufacturing Company, Kansas City, Mo. Mr. Holdren will maintain headquarters at Richmond, Va., and will cover southeastern states. He formerly was with the Richmond, Fredericksburg & Potomac and the Atlantic Coast Line.

◆

WIX ACCESSORIES CORPORATION.—The Wix Accessories Corporation, Gastonia, N. C., has acquired extensive new facilities adjacent to the company's main plant. The site acquired includes a large modern brick building containing over 70,000 sq. ft. of additional manufacturing and warehousing floor space approximately 150,000 sq. ft. of space is available for future


Need coated insulation?


...or insulating varnishes?

additions. Work has already begun on additional headquarters offices and on increased laboratory and engineering facilities.

◆

General Motors Corporation.—*John R. Gilmartin* has been appointed general sales manager of the *Hyatt Bearings Division* of General Motors in Harrison, N. J. Mr. Gilmartin succeeds *Howard K. Porter* who has become assistant to general manager on special assignments.

Mr. Gilmartin joined the Hyatt Bearings Division in Detroit upon graduating from the University of Michigan in 1929. He was first associated with the Engineering Department and subsequently became

J. R. Gilmartin

a sales engineer before his transfer to the Hyatt home office in 1941. At Harrison he assumed charge of all Government contracts and priorities and later served as assistant production manager. In 1947 he was appointed assistant to the general sales manager.

Mr. Porter joined the Hyatt Bearings Division in 1916 and during the years held various engineering and sales positions at Harrison. In 1926 he became assistant general sales manager and in 1930, general sales manager.

The headquarters of the Southeastern Region of the *Electro-Motive Division* of General Motors have been moved from Washington, D. C., to 118 West Adams street, Jacksonville, Fla., in order to provide closer liaison on not only sales and service activities, but also on activities of the Jacksonville Factory Rebuild Branch between the sales and service personnel and the railroads of the southesast. *R. L. Terrell*, Southeastern Regional Manager, continues in charge.

Major cuts have been made in labor charges on rebuilding principal components of diesel locomotives in the six "factory rebuild" plants of the *Electro-Motive Division* of General Motors. *N. C. Dezendorf*, vice-president of G. M. and general manager of the division, said that all of the firm's diesel locomotive customers have been formally advised that the labor charge upon strip and rewind of traction motor armatures is reduced by 30 per cent and that labor charges upon all other catalogue-listed rebuilding operations are reduced 10 per cent. The traction motor armature-rewind job constitutes the largest single item in the business of the factory branches. The reductions are the direct result of technological advances which have drastically reduced costs, Mr. Dezendorf explained. He pointed out that, since E.M.D. went into the business of rebuilding traction motors, generators, engines and other major components of locomotives for the railroads shortly after the close of World War II, the average hourly wage rates at the factory branches have gone up 59 per cent. "We not only have been able to completely offset this inflationary influence but now are able to announce these drastic reductions," Mr. Dezendorf said. "This is largely due to a program of complete retooling of the factory branches started two years ago and now almost completed. The program has converted these plants from job shops into true production shops where the same high production methods and machinery used in the original manufacturing operations at the main locomotive plants are duplicated."

In the normal operation of diesel locomotives certain of the major components reach a point, ranging from every year and a half to 12 years of their life, in which they need to be completely torn down and rebuilt. The rebuilding operations which it holds itself out to perform for the railroads are not to be confused with the regular repair and maintenance work on diesel locomotives which all carriers continue to do—as they have upon steam locomotives. E.M.D. now operates plants for rebuilding operations at LaGrange, Ill., Baltimore, Jacksonville, Los Angeles, Oakland and St. Louis. Land has been purchased for an additional plant at Salt Lake City.

◆

American Wheelabrator & Equipment Co.—*Walter S. Schamel* has been appointed district manager for American Wheelabrator at 3155 Leonis Boulevard, Vernon, Los Angeles 58.

◆

Ansul Chemical Company.—*Paul R. Larimer* has been appointed general sales manager of the Ansul Company, Marinette, Wisc. Mr. Larimer will be in charge of all four sales divisions—fire extinguisher, refrigeration, industrial chemicals and ex-

P. R. Larimer

port. Mr. Larimer formerly supervised the company's government relations program and served as assistant sales manager of the Fire Extinguisher Division. At one time, he was co-owner of Thunderbird Sales Corporation, Phoenix, Ariz., a distributor of Ansul fire extinguisher equipment.

◆

William Brand & Co.—*Ambrose C. Miller* has been appointed product engineer for William Brand & Co., Willimatic, Conn.

◆

Johns-Manville Corporation.—A major expansion is being made at the Watson, Cal., plant of Johns-Manville. Completion of the new building, enclosing approximately 100,000 sq. ft. of floor space, is expected in the early fall of 1953.

HEYWOOD-WAKEFIELD COMPANY.—*Bryant H. Burns*, who has been appointed to the transportation seating division sales staff of the Heywood-Wakefield Company, with headquarters at New York, succeeding the late *Guy M. Ralph*. Mr. Burns formerly was chief expeditor for the transportation seating division, at Gardner, Mass.

B. H. Burns

◆

AIR REDUCTION SALES COMPANY.—The railroad department of the *Air Reduction Sales Company*, a division of the Air Reduction Company, has announced appointments of *S. S. Bruce, Jr.*, and *J. S. Stevens* as zone managers, eastern region, with headquarters at Philadelphia and Waycross, Ga., respectively.

◆

EUTECTIC WELDING ALLOYS CORPORATION.—A Railroad Welding Advisory Service in the use of Eutectic low-temperature welding rods has been inaugurated by the Eutectic Welding Alloys Corporation, Flushing, N. Y., The service is headed by *Hugh H. Hurley*.

H. H. Hurley

◆

BARCO MANUFACTURING COMPANY.—Work on a new plant and office building at Barrington, Ill.—a Chicago suburb—has been begun by the Barco Manufacturing Company. The new plant, at 500-530 Hough street, will contain approximately 103,000 sq. ft. of floor area. The building is expected to be ready for occupancy

around the first of next year, at which time the company will vacate its present facilities in Chicago.

◆

UNITED STATES STEEL CORPORATION.—*Howard Heiser* and *Earl L. Simanek* have been appointed assistant district sales managers of the *United States Steel Supply Division*, with headquarters at Chicago.

◆

INTERNATIONAL RAILWAY CAR COMPANY.—The *International Railway Car & Equipment Manufacturing Co.*, of Kenton, Ohio, and Buffalo, N. Y., has changed its official firm name to International Railway Car Company.

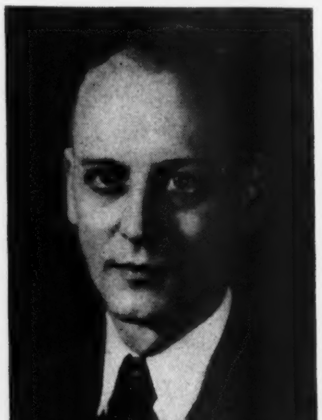
H. K. PORTER COMPANY.—A new stock-carrying branch warehouse and sales office has been established by the *Quaker Rubber Corporation*, division of the H. K. Porter Company, at 2201 N. Washington avenue, Minneapolis, under overall supervision of *T. H. Olson*, Midwest district manager.

◆

WHITING CORPORATION.—*J. A. Handley* has been elected president and also a director of the Whiting Corporation, Harvey, Ill. Mr. Handley was vice-president and chief executive officer for the past year, and before that was manager of the company's branch plant in California.

AMERICAN BRAKE SHOE COMPANY.—*Charles F. Weil*, sales representative at Chicago, retired on August 1 after 47 years in the engineering and sales departments of American Brake Shoe. Mr. Weil, who will continue in railway sales work as a manufacturers' representative, is secretary-treasurer of the Allied Railway Supply Association. *Thomas J. Wood* has been appointed operating assistant to the president of Brake Shoe & Castings Division of American Brake Shoe and *Raymond A. Frick* has been appointed general works manager of the Division.

Mr. Wood joined the Division as assistant metallurgist in 1939. He became superintendent of the Mahwah, N. J., foundry



T. J. Wood

in 1943, and district works manager in 1949. Prior to his new appointment he was cheif metallurgist for the Division. He is a graduate of Lehigh University.

Mr. Frick joined the company as an apprentice in 1942. He was appointed foundry foreman of the Buffalo plant in 1947, and superintendent of the N. Kansas City plant in 1948. Prior to his new appointment he was district works manager.

R. A. Frick

He is graduate of the University of Pennsylvania and served in World War II in the Army Air Corps.

◆

JOSEPH DIXON CRUCIBLE COMPANY.—*Ralph C. Gough* has been appointed special representative in the New England area for the Joseph Dixon Crucible Company.

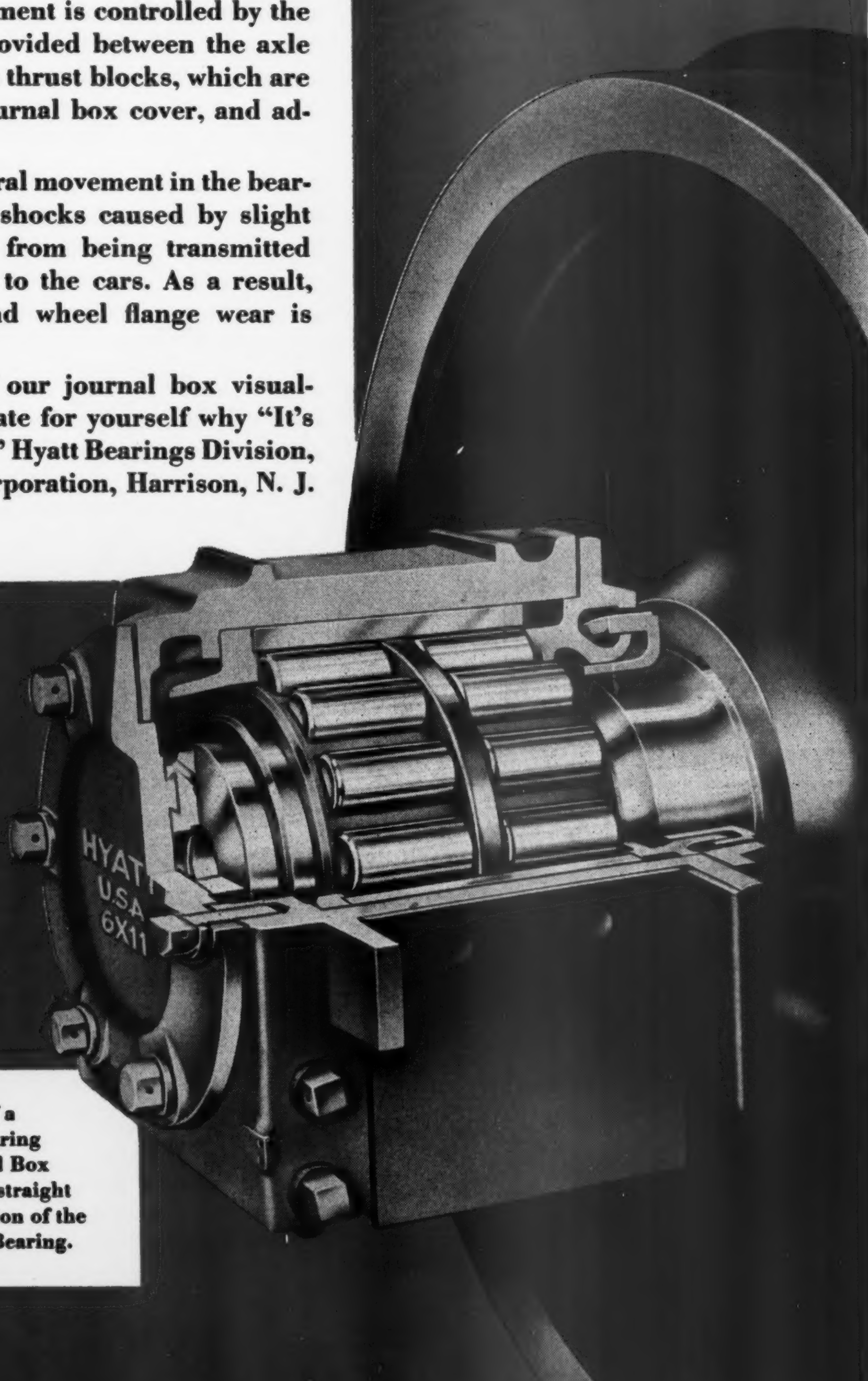
FREE LATERAL for EASY RIDING

Hyatt Railroad Roller Bearings are constructed so that the bearing inner race, which is shrunk on the car journal, can move laterally within the cage and roller assembly.

This lateral movement is controlled by the amount of space provided between the axle ends and the bronze thrust blocks, which are integral with the journal box cover, and adjustable.

Providing for lateral movement in the bearing prevents many shocks caused by slight track irregularities from being transmitted through the trucks to the cars. As a result, cars ride easier and wheel flange wear is reduced.

Write for one of our journal box visualizers and demonstrate for yourself why "It's Easier With Hyatts." Hyatt Bearings Division, General Motors Corporation, Harrison, N. J.



Cut-away view of a Hyatt Roller Bearing Railroad Journal Box showing simple straight radial construction of the Hyatt Railroad Bearing.

HYATT ROLLER BEARING JOURNAL BOXES

FARR COMPANY.—The Farr Company, of Los Angeles, has appointed *Robert S. Bebb*, of Los Angeles, as division sales manager, supervising the Western division. *James E. Matuska*, of Seattle, has been appointed district sales manager for the Northwest district.

◆

GENERAL AMERICAN TRANSPORTATION CORPORATION.—*LeRoy Kramer, Jr.*, has been appointed assistant vice-president of the General American-Evans Company division.

◆

SPRING PACKING CORPORATION.—*Chauncey Krout* has been appointed to assist the eastern sales manager at Philadelphia, and *Milton Brunner* has been appointed chief engineer at Chicago.

◆

STANDARD PRESSED STEEL COMPANY.—*Marshel Moorhouse* has been appointed sales representative, New York City territory. *Walter H. Cunnington* represents the company at St. Louis and handles sales in middle Illinois, Missouri, Kansas and parts of Iowa. *James C. Humphries*, sales representative in Los Angeles, will sell in California, Washington and Oregon. *Francis J. Kinsella*, sales manager in the Detroit territory, has been appointed to the newly created post of regional sales manager in the midwest. His headquarters will continue to be in the Detroit territory offices at 944 Harper avenue. *Daniel F. Hulgrave, Jr.*, who has been with the Standard Pressed Steel sales organization in Detroit since 1949, succeeds Mr. Kinsella as manager of the Detroit territory.

◆

PRESSED STEEL CAR COMPANY.—*C. J. Plisky* has been appointed vice-president in charge of production of the Pressed Steel Car Company. Mr. Plisky was previously vice-president in charge of the

C. J. Plisky

firm's Unicel and Jahn Trailer divisions. He joined the company in 1941 as a foreman in the machine shop of the armored tank division at the Hegewisch (Chicago), Ill., plant, and became plant manager in 1947.

◆

PYRENE MANUFACTURING COMPANY.—*S. C. Williams* has been appointed general field sales manager, and *Walter W. Kemphert*, mid-west district manager, of the Pyrene Manufacturing Company. Mr. Williams, who has worked for Pyrene as sales representative in Louisville, Ky., special assistant to the president at Newark, and district manager at Newark and Chicago, will now be in charge of all field operations and district office personnel. Mr. Kemphert joins Pyrene after holding the positions of mid-west regional manager of the American Pulley Company, vice-president in charge of sales of Skilsaw, Inc., and manager of the merchandising division of the Worthington Pump & Machinery Corp.

◆

UNITED STATES STEEL CORPORATION.—*William F. Jones* has been appointed manager of sales, Chicago district office, of United States Steel's *National Tube division*, succeeding the late *J. S. Raymond*.

◆

FAIRBANKS, MORSE & CO.—*R. H. Morse, III*, formerly assistant general manager of Fairbanks, Morse & Co., at Chicago, has been appointed general manager of the Beloit (Wisc.) Works, to succeed *Orren S. Leslie*, who has been appointed manager of manufacturing, with headquarters at Chicago.

Mr. Morse, who will now direct all phases of operation at Beloit, began his career with the company at the Beloit plant in 1946. He worked in various capacities, including that of foreman in foundry pro-

duction control, assistant to the manager of engineering and, for the past several years, assistant general manager.

◆

ELLCON COMPANY.—*Thomas B. Wood, Jr.* has joined the Ellcon Company as a sales assistant. Mr. Wood, formerly with

T. B. Wood

the National Pneumatic Company, will be engaged in sales to railroads and transit companies.

◆

WESTINGHOUSE ELECTRIC CORPORATION.—*Donald R. Jenkins* has been appointed manager of the newly formed gas-turbine application engineering section of the steam division of the Westinghouse Electric Corporation, at South Philadelphia, Pa. The section has been formed to handle all company negotiations involving gas turbines for land and marine service. Mr. Jenkins has been an application engineer in the electric utility department of the district office in Salt Lake City since February 1951.

◆

MINNEAPOLIS - HONEYWELL REGULATOR COMPANY.—Minneapolis-Honeywell has expanded the sales organization of its transportation division with the appointment of three new field engineers and the addition of other personnel in a number of major cities. *James Ayers,* formerly with the Electro-Motive Division of General Motors Corporation, has been appointed field engineer in San Francisco; *Anthony J. Orlando,* formerly with the New York Central, field engineer in New York; and *John McSweeney,* field engineer in Cleveland. *Milton Edgren,* formrely with the Pullman Company, and *Allen F. Blanding,* formerly service installation manager of Honeywell's Syracuse, N. Y., branch office, have been appointed application and service engineers in Chicago and New York, respectively. *Donald Plasterer,* formerly with International Business Machines, has been appointed application engineer in Chicago. *W. R. Barnard,* field engineer, has been transferred from Richmond, Va., to Philadelphia; *K. E. Koza,* field engineer, from Chicago to St. Louis; and *T. R.*

Wagner, from the commercial division to transportation engineer at Minneapolis.

◆

WIX ACCESSORIES CORPORATION.—The Wix Accessories Corporation, Gastonia, N. C., has acquired new plant facilities adjacent to its main plant, including a modern brick building containing over 70,000 sq. ft. of additional manufacturing and warehousing space.

◆

BETHLEHEM STEEL COMPANY.—*Rufus E. Dudley*, assistant metallurgical engineer on the staff of the steel division of the Bethlehem Steel Company, has retired.

Obituary

C. N. THULIN, at one time vice-president of the Duff-Norton Manufacturing Company, and more recently representing the Joyce-Cridland Company, died at Marshalltown, Iowa, on July 21.

LOUIS CHARLES HUCK, 56, president of the Huck Manufacturing Company, Detroit, died recently.

WILLIAM LUTHER LEWIS, 68, president of the Chicago Pneumatic Tool Company, died on June 28. A native of Wales, Mr. Lewis was brought to this country as a boy. He was elected vice-president, secretary and treasurer of Chicago Pneumatic Tool in 1930 and president in 1946.

THOMAS CRUTHERS, vice-president of the Worthington Corporation since 1936, died on July 27, at his West Orange, N.J., home.

GUY M. RALPH, formerly a member of the transportation seating division sales staff of the Heywood-Wakefield Company at New York, died recently, after a long illness.

MAX SCHILLER, retired vice-president and treasurer of The Superheater Company, now a division of Combustion Engineering—Superheater, Inc., died on Tuesday at his home in New York of coronary thrombosis. Mr. Schiller, who was 65, had served as president of the American Throttle Company.

Born in Vienna, he came to this country as a young man and settled in Yonkers. He began as a clerk in the office of The Locomotive Superheater Company in 1910 and advanced in its financial department. Surviving are his widow, a son, two daughters and four grandchildren.

FREDERICK WILLIAM ALGER, 58, assistant vice-president of the Pullman-Standard Car Manufacturing Company, died on August 3, at his home in Chicago.

WILLIAM G. PEARCE, 93, who retired in 1950 as chairman of the board of the American Brake Shoe Company, died on July 15. Mr. Pearce began his career in the office of the auditor of the Northern Pacific, where he advanced to the position of general manager. In 1902 he left that road to become vice-president of the Griffin Wheel Company, Chicago, and in 1910 joined the American Brake Shoe as vice-president. He became president in 1916, chairman of the executive committee in 1939 and, later, chairman of the board.

PERSONAL MENTION

Canadian National

E. J. COOKE, superintendent of car shops at Transcona, Man., appointed assistant general superintendent car equipment, central region, with headquarters at Toronto.

Chicago, Milwaukee, St. Paul & Pacific

A. G. HOPPE, engineer of research and development, appointed mechanical engineer. Office of engineer of research and development at Milwaukee abolished.

H. H. MELZER, assistant mechanical engineer, appointed chief engineer of tests, with headquarters at Milwaukee.

D. C. SHEFFIELD appointed engineer of tests (diesel), with headquarters at Milwaukee.

G. H. KOESTER appointed assistant to the superintendent of motive power at Milwaukee.

E. H. HEIDEL, general boiler inspector at Milwaukee shops, has retired.

A. A. EDLUND, assistant boiler inspector at Milwaukee, appointed general boiler inspector at Milwaukee shops.

Elgin, Joliet & Eastern

CHARLES J. TRACY, wood-shop foreman at Joliet, appointed general car foreman at Joliet.

Erie

GORDON E. MCKINNEY appointed chief electrical engineer at Cleveland, as reported in July issue.

Born: 1898, at Ruston, La.

Education: Graduate of Louisiana Polytechnic Institute in 1915.

Career: Became special apprentice in Jersey City shops of Erie in 1916, subsequently becoming electrician foreman at Kent, Ohio; supervising electrician at Youngstown, Ohio, and supervisor of electrical repairs at Hornell and Jersey City. Appointed system electrical engineer in 1943. A picture of Mr. McKinney appeared in the July issue with the announcement of his appointment.

JOHN H. RAY appointed electrical engineer at Cleveland.

Born: October 16, 1911, at Matamoras, Pa.

Education: Penn State (B.S.E.E. 1933).

Career: Became employed by the Erie as special apprentice (electrical) May 8, 1934; gang leader, May 5, 1938; assistant electrical foreman at Hornell, N. Y., April 17, 1939. Entered the service of the U. S. Army as a first lieutenant, Corps of Engineers, March 29, 1941, advancing to the rank of lieutenant colonel, Corps of

J. H. Ray

Engineers, Army of the United States on May 9, 1944. Now a colonel in the United States Army Engineer Reserve. Returned to the Erie on January 16, 1946, as assistant electrical foreman and acted as special representative for the electrical engineer in the rebuilding of damaged diesel-electric locomotive units. On January 16,


TRADE SECRET

1947, appointed diesel locomotive gang foreman in charge of maintenance and repairs at the diesel shop at Marion, Ohio; on December 1, 1947, appointed diesel shop foreman in charge of installation and operation of maintenance repair facilities at Hornell, and on December 1, 1948, appointed assistant electrical engineer at Cleveland.

Ray Arthur Mylius appointed assisant electrical engineer at Cleveland.

Born: April 16, 1910, at Newark, Ohio.

Education: Ohio University (1928-1930); Carnegie Technological Institute (1930-34—B.S. in E.E.).

Career: 1934-37, Ohio Power Company; 1937-46, Virginian Railway; 1946-48, Ohio Ferro Alloys Corporation; 1948-, Erie.

Missouri-Kansas-Texas

Clay M. Lewis, Jr., chief chemist at Parsons, Kan., appointed engineer of tests at Parsons.

Earl V. Seifert, car and locomotive draftsman, appointed to newly created position of assistant engineer of tests at Parsons, Kan.

New York, New Haven & Hartford

Kenneth Cartwright, general mechanical superintendent appointed consulting engineer, with headquarters as before at New Haven.

Born at West Epping, N. H.

Education: Graduate of Massachusetts Institute of Technology in 1912.

Career: Joined the New Haven as material inspector in June 1914. After service during World War I as a lieutenant in the

Kenneth Cartwright

Navy, returned to the New Haven in 1920 as assistant to engineer of tests, becoming general mechanical inspector in 1923, assistant mechanical engineer in June 1925, mechanical engineer in September 1935, chief mechanical engineer in April 1944, and general mechanical superintendent in April 1951.

W. J. Harlow, assistant general mechanical superintendent at New Haven, appointed general mechanical superintendent at New Haven.


SCULLIN L-V 50 TRUCK
LATERAL VERTICAL
SCULLIN L 50 V TRUCKS
CUSHIONED MOTION
THE SMOOTHEST TRAFFIC-BUILDERS
BETWEEN LCL AND YOUR RAILS
STEEL CASTINGS MANUFACTURER
NEW YORK
CHICAGO
BALTIMORE
RICHMOND, VA.
SCULLIN STEEL CO.
SAINT LOUIS 10, MISSOURI

Norfolk & Western

Carl C. Stevens, car repairer at Portsmouth, Ohio, appointed gang foreman at Columbus, Ohio.

Northern Pacific

H. E. Brakke, appointed mechanical engineer at St. Paul, as noted in the August issue.

Education: Graduate of University of Minnesota (1931).

Career: Joined the NP as a special apprentice. During World War II served as an officer in the U. S. Army, returning to the NP in 1946 as draftsman in the mechanical engineer's office at St. Paul. Subsequently became assistant to general car foreman at Brainerd, Minn., and in March 1952 was appointed assistant to mechanical engineer.

Pennsylvania

R. C. Johnston, assistant master mechanic at Pitcairn, Pa,, appointed master mechanic at Chicago.

C. C. Hanly appointed master mechanic, Philadelphia division.

T. J. Sheridan, master mechanic, Chicago division, appointed acting master mechanic, Susquehanna division.

M. J. Mitchell, assistant foreman, Ebenezer enginehouse, Northern division, appointed foreman — diesel maintenance, Northern division.

F. P. Reynolds, Jr., special duty engineman, Fort Wayne division, appointed assistant road foreman of engines, Chicago division.

Jay Gould, assistant road foreman of engines, Chicago division, appointed assistant road foreman of engines, Southwestern division.

St. Louis-San Francisco

Max A. Herzog, chief chemical, appointed engineer of tests at Springfield, Mo. Mr. Herzog will head a new department established to handle the testing of oils and other materials, inspection of water, and similar activities for the entire system.

Southern

Samuel R. Floyd, general foreman car repairs at Charleston, S.C., appointed general foreman car repairs at Alexandria, Va.

Paul T. Hoskins, assistant engine-house foreman at Asheville, N.C., appointed general foreman at Asheville.

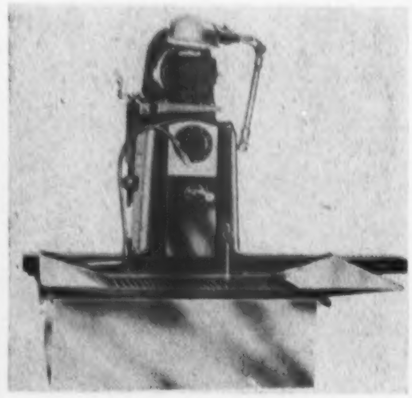
Judson V. McKaughan, assistant enginehouse foreman at Appalachia, Va., appointed general foreman at Appalachia.

Robert E. Liles appointed foreman freight car repairs at Jacksonville, Fla.

Hobert B. Kropff appointed assistant foreman freight car repairs at Coster shop, Knoxville, Tenn.

New Devices

(Continued from page 116)



Bench Model Honing Machine

A bench model honing machine, combining a portable coolant unit has been announced by the Superior Hone Corporation, Elkhart, Ind. Called the model J, it features infinitely variable spindle speeds—400 to 1,000 r.p.m. with no changing of belts; a honing range from 0.185 in. to 2.500 in. in dia. and permanent type mandrels.

The portable coolant device complements the honing unit. Range of adjustment makes it adaptable to any dry honing machine and provides conversion from dry to wet operation.

Overall dimensions of the unit are 25 in. high, 13 in. wide and 16½ in. deep. Its motor is ⅓ hp. and operates from a 110-volt, 60-cycle, 1-phase supply.

◆

Air-Operated Butterfly Valve

Developed for the control of air, water or steam flow is a contribution of the Industrial division of the Minneapolis-Honeywell Regulator Company, Minneapolis, Minn.—a pneumatically operated butterfly valve.

This device is sized from 1½ in. to 6 in., with screwed connections. Its body, wing and trim material is fabricated in bronze. The unit has a maximum operating temperature of 250 deg F. and maximum pressure is limited to 20 lb. per sq. in.

Described as the Grad-U-Motor, it operates on a controlled air pressure range of zero to 15 lb. per sq. in. Adjustable mechanical stops provided on the motor enable the wing rotation to be limited for special applications. An optional accessory is the Gradutrol relay for positive valve positioning on throttling control installations.

◆

Spring Wire Connector

A new spring-type connector that requires no tools for making pigtail splices in electrical wiring, has been introduced by Minnesota Mining and Manufacturing Co., 900 Fauquier st., St. Paul, Minn.

Designated the Scotchlok brand electrical spring connector, it is said to provide a tight permanent splice for single- or multi-strand wires up to gage 10 in more than 300 different combinations.

Made of zinc-plated steel wire in the form of a tapered coil spring, the lubricated connector is screwed on the stripped ends of the wires with the fingers. A notched turning stem provides adequate leverage during application and is then snapped off leaving a neat splice with no sharp ends.

The coil spring design allows the connectors to expand while being applied, but provides a shake resistant, tension grip

You are sure of SAFE, POSITIVE signals with U. S. Railroad Cables

These Cables have all the United States Rubber Company developments that make for positive safety. "U. S." has been a pioneer in insulation for over 60 years—has accumulated research data and unmatched experience. Electrical insulation is a "U. S." specialty. U. S. Railroad Cables are manufactured to your specifications.

Typical of U. S. Signal Cables for underground use is specification No. 871 embodying the following:

- Solid, annealed coated copper conductor.
- An insulation that is a high heat- and moisture-resistant compound with high insulation resistance and voltage breakdown, as well as low dielectric constant, low transmission loss and low power factor. The thickness of the insulation is .078″ for conductor sizes 14 through 8 and .094″ for conductor size 6.
- A neoprene jacket is bonded to the insulation, providing it with long-time protection against acids, alkalies, heat, light, oil and mechanical abuse, particularly at the exposed ends. The thickness of this jacket is .020″ for conductor sizes 14 through 10, and .030″ for conductor sizes 8 and 6.
- Moisture-resistant, non-wicking rubber fillers are used as required.
- A rubber-filled tape providing cushioning for the outer jacket is applied over the assembly.
- An outer jacket made of neoprene is applied over the taped assembly for additional physical and chemical protection.
- A rubber-filled tape is applied over the outer neoprene jacket to serve as bedding for the bronze tape.
- A bronze tape is applied, providing a tough, non-corrosive barrier against rodents, termites and microorganisms.
- The overall protective covering consists of a jute braid weatherproofed and treated with mica for protection of the bronze tape during the installation and in service.

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Electrical Wire and Cable Department, Rockefeller Center, New York 20, N. Y.

on the wires once the splice has been made.

The small diameter of the connector adds only a fraction of an inch to the diameter of the wires, making it suitable for joining wires in crowded junction boxes.

Recommended insulation for use with the connector is plastic Scotch electrical tape No. 33, providing a water- and oil-resistant splice.

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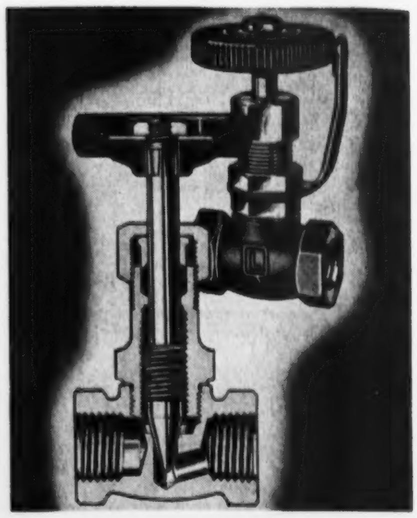
Gland Type Needle Valve

A gland type needle valve, made of bronze, has been announced by The Lunkenheimer Co., Cincinnati, Ohio. The device, available in globe and angle patterns, is small and compact and can be used in pin-point control on small lines where fine regulation of flow is essential. It is manufactured in a range of sizes from ⅛ to 1-in.

This control valve is also produced in an indicator model. The indicator globe is available in ¼, ⅜ and ½-in. sizes and the angle is available in ¼ and ⅜-in. sizes. Its handwheel is of cast bronze and has numbered graduations indicated on its face, permitting resetting to a predetermined degree of opening. A spring clip engaging serrations on the outside of the wheel, holds the valve at its proper setting.



With the introduction of these units to the line, Lunkenheimer now produces needle valves in 13 patterns, including a complete line of bar stock steel needle valves in carbon steel, 13 per cent chromium stainless and 18-8-Mo stainless steel.

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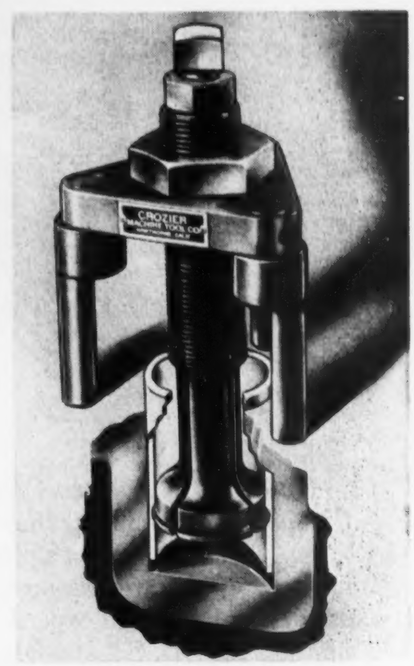

Bushing and Bearing Extractor

Engineered on a new principle, a bushing and bearing extractor for blind holes has been introduced by the Crozier Machine Tool Co., Hawthorne, Calif. This product, according to its manufacturer, saves as much as 75 per cent of the labor time in extracting bushings, bearings, sleeves, liners, roller bearing cups, and races of magnet type bearings and similar objects.

The extractor eliminates the necessity of machining bearings, minimize the hazard of injuring casings or excessive dismantling of equipment. It consists of eight threaded expanding arbors, a draw table with two sets of legs, short and long, adjustable as to distance from the work, and